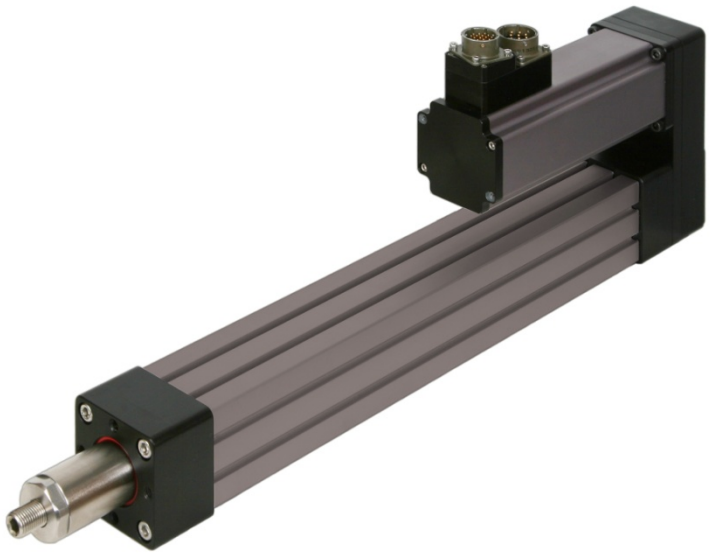
K-Series Universal Motor Mount
Roller Screw Actuators
Installation & Service Manual



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1.0 Introduction

1.1 Warranty and Limitations of Liability

EXLAR warrants its product(s) to the original purchaser and in case of original customer equipment manufacturers, to their original customer to be free from defects in material and workmanship and to be made in accordance with Exlar's specifications for the product(s) as published at the time of purchase unless otherwise agreed to in writing by an authorized Exlar representative. In no event, however, shall EXLAR be liable or have any responsibility under such warranty if the product(s) has been improperly stored, installed, used or maintained, or if Buyer has permitted any unauthorized modifications, adjustments and/or repairs to such products(s).

Seller's obligation hereunder is limited solely to repairing or replacing (at its option), at the factory any products(s), or parts thereof, which prove to Seller's satisfaction to be defective as a result of defective materials or workmanship, and within the period of time, in accordance with the Seller's stated product warranty (see terms and conditions), provided, however, that written notice of claimed defects shall have been given to EXLAR within thirty (30) days from the date any such defect is discovered. The product(s) or part(s) claimed to be defective must be returned to EXLAR, transportation prepaid by Buyer, with written specification of the claimed defect.

Components such as seals, wipers, bearings, bushings, splines, and roller screws are considered wear parts and must be inspected and serviced on a regular basis. Any damage caused by failure to properly lubricate EXLAR products and/or to replace wear parts at appropriate times, are not covered by this warranty.

The FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES (EXCEPT AS LITTLE), WHETHER EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, OR OF FITNESS FOR ANY PARTICULAR PURPOSE, OTHER THAN AS EXPRESSLY SET FORTH AND TO THE EXTENT SPECIFIED HEREIN, AND IS IN LIEU OF ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF EXLAR.

SELLER'S MAXIMUM LIABILITY WITH RESPECT TO THESE TERMS AND CONDITIONS AND ANY RESULTING SALE, ARISING FROM ANY CAUSE WHATSOEVER, INCLUDING WITHOUT LIMITATION, BREACH OF CONTRACT OR NEGLIGENCE, SHALL NOT EXCEED THE PRICE SPECIFIED HEREIN OF THE PRODUCT(S) GIVING RISE TO THE CLAIM, AND IN NO EVENT SHALL EXLAR BE LIABLE UNDER THIS WARRANTY OTHERWISE FOR SPECIAL, INCIDENTAL OR CONSEQUENTAL DAMAGES, INCLUDING WITHOUT LIMITATION, DAMAGE OR LOSS RESULTING FROM INABILITY TO USE THE PRODUCT(S), INCREASED OPERATING COST, LOSS OF PRODUCTION, LOSS OF SPECIAL INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER SIMILAR OR DISSIMILAR, OF ANY NATURE ARISING OR RESULTING FROM THE PURCHASE, INSTALLATION, REMOVAL, REPAIR, OPERATION, USE OR BREAKDOWN OF THE PRODUCT(S), OR ANY OTHER CAUSE WHATSOEVER, INCLUDING NEGLIGENCE.

The foregoing warranty shall also apply to products or parts which have been repaired or replaced pursuant to such warranty, and within the period of time, in accordance with Seller's stated warranty.

No person including any agent or representative of EXLAR, is authorized to make any representation of warranty on behalf of EXLAR concerning any products manufactured by EXLAR, except to refer purchasers to this warranty.

1.2 Safety Considerations

As with any electro-mechanical device, safety should be considered during installation and operation of your K Series actuator. Throughout this manual you will see paragraphs marked with a CAUTION sign as shown below.

CAUTION

Pay particular attention to these paragraphs. They are intended to provide you with helpful information to ensure a safe and trouble free installation and operation.

Care should be taken not to exceed the physical travel limits of K Series actuators. Doing so will cause the actuator to impact its end travel bumpers. Repeated end travel crashes can physically damage the roller screw and the internal components of the actuator.

Care should be taken to avoid high speed impact with objects of high rigidity that immediately stop the travel of the actuator with no deceleration or energy absorption. An example would be a high speed impact of two solid steel parts. The resulting impact will create a very short effective deceleration time. Kinetic energy contained in the rotating inertia of the actuator and motor can possibly generate extremely high impact forces that exceed the mechanical capacities of the actuator and cause physical damage to the actuator. For applications requiring this type of impact, contact Exlar application engineering to insure that the actuator is properly sized or provisions are made to absorb the induced energy.

1.3 K Series Linear Actuators Overview

Exlar K Series actuators are offered in two standard nominal frame sizes of 60 and 90 millimeters.

Continuous duty thrust load rating for the K Series product range from 575 lbf. to 3,500 lbf. (2558-15,569 N). Intermittent load ratings for each actuator are twice the respective continuous duty load rating.

Exlar KM, KX, and KT Series actuators utilize a planetary roller screw mechanism to convert rotary to linear motion. KA Series actuators use an acme screw.

1.4 Actuator Configurations

The K Series base unit actuator includes a high performance planetary roller screw assembly or acme screw, bearing support, anodized extruded aluminum housing, precision internal anti-rotate sliders, extending rod, and an input shaft for attachment to your drive system. A K Series base unit is shown below.

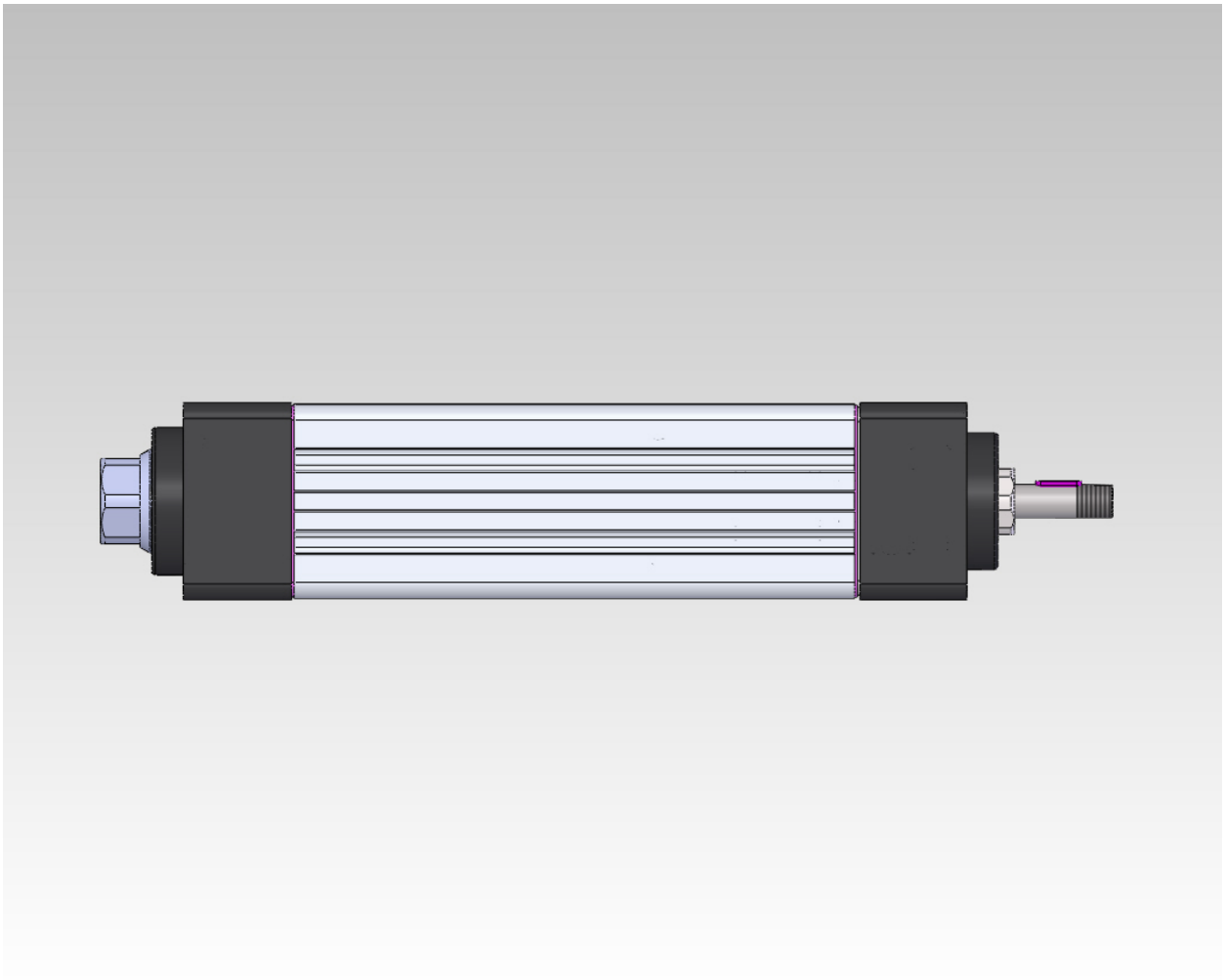


Figure: K Series Base Model Actuator

The K Series actuators are also available with provisions for mounting various motors. Standard motor mountings include parallel with belt drive and inline drive.

Parallel Drive K Series Actuator

Parallel drives use a timing belt and pulleys, and come in ratios of 1:1, 1½ :1 and 2:1 for the K60 actuator and 1:1 and 2:1 for the K90 actuator. A parallel unit is shown below.

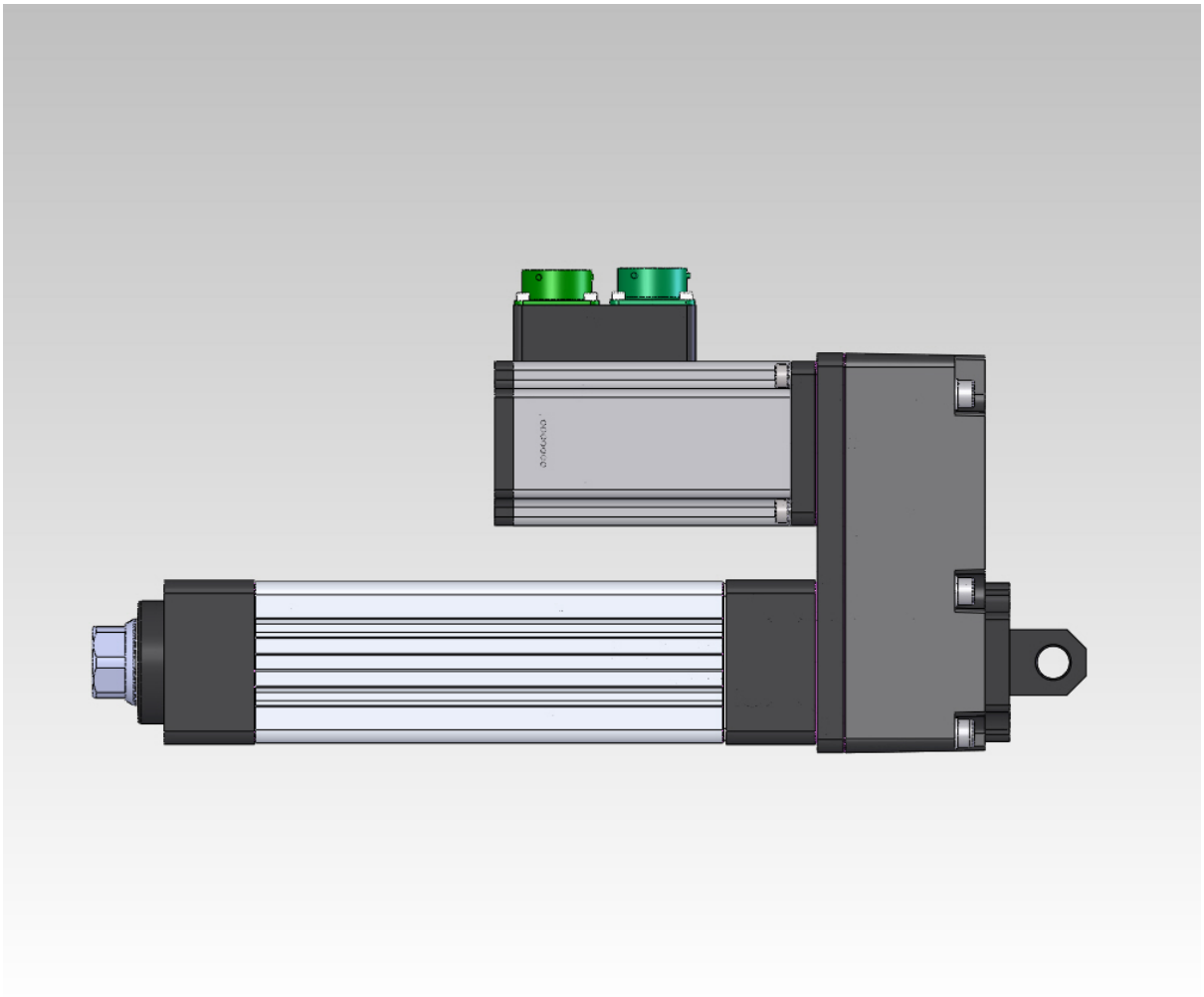


Figure: K Series with Parallel Motor Mount

Inline Drive K Series Actuator

The inline motor mounting configuration uses a coupling, attaching the motors output shaft to the actuators input shaft. An inline unit is shown below.

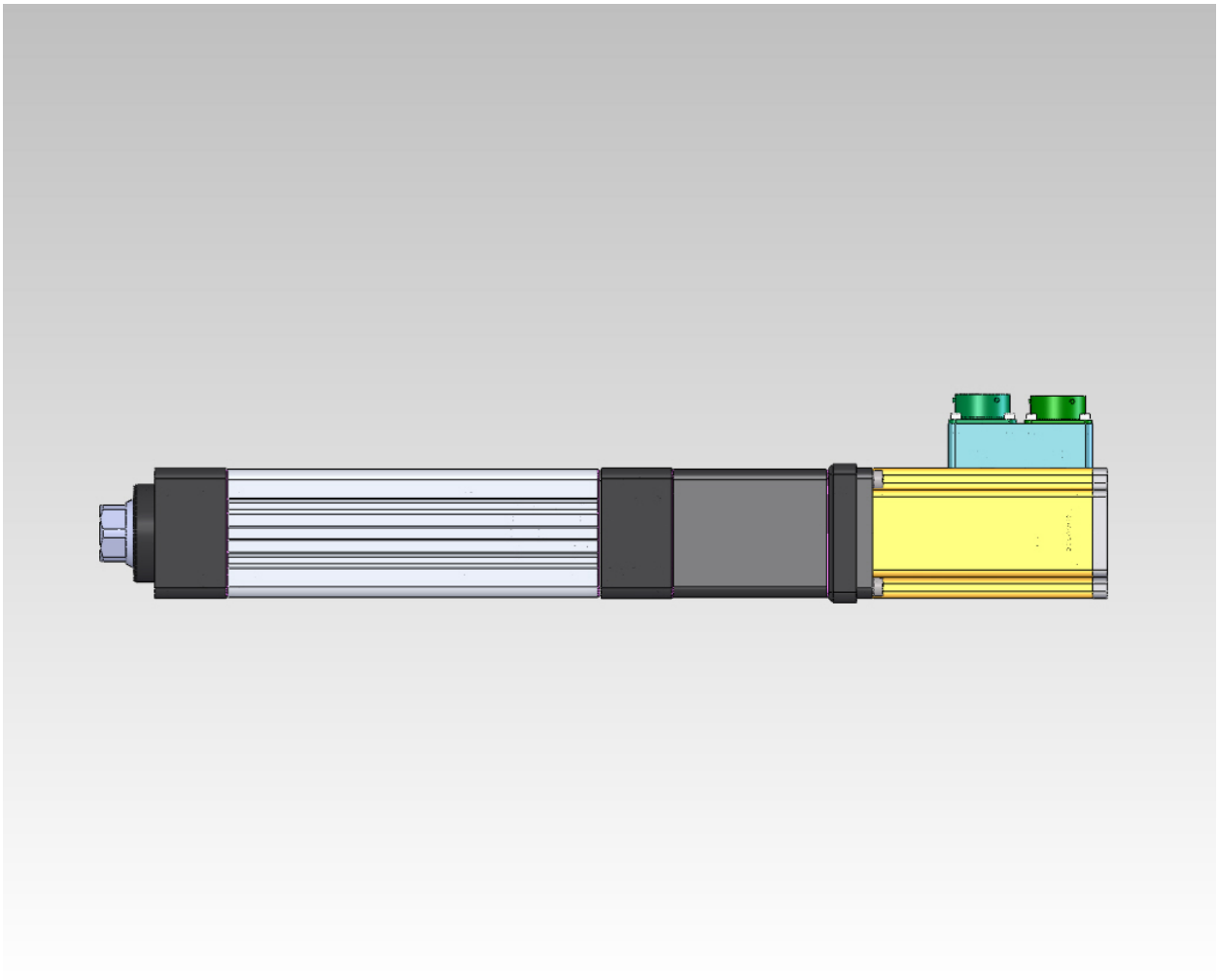


Figure: K Series with Inline Motor Mount

The inline option with a gear motor offers planetary gear reduction. The planetary gearing is integral to the gear motor. An inline unit with a gear motor is shown next page.

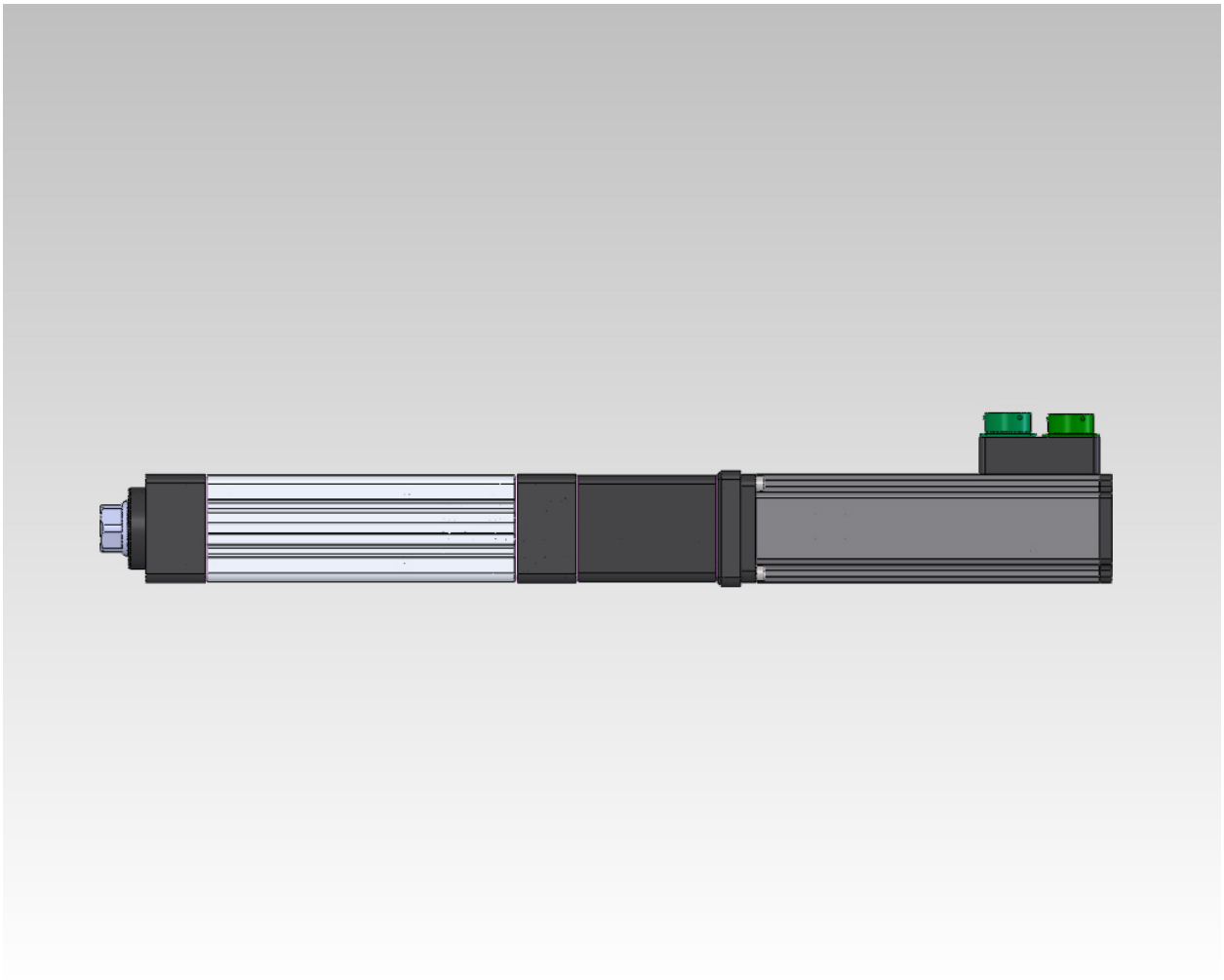


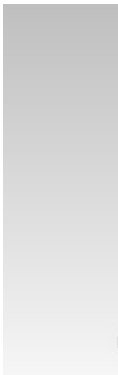
Figure: K Series with Inline Gear Motor Mount

2.0 Installation

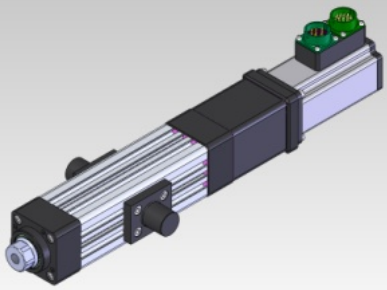
2.1 Mounting Configurations

The K Series actuators offer a variety of mounting accessories. The standard mounting accessories are; foot plate mounts or side mounted trunnions. Each of these mounting components utilizes the T-Slot tracks on the sides of the case for attachment. Also available are flange plate mounts. Flange plates can be bolted to the front and rear of the actuator depending on whether an inline motor mount actuator or a parallel motor mount actuator is used. Also available are angle plate mounts for both inline and parallel motor mount actuators. Also available, for the parallel and inline motor mount actuators, are eye plates and clevis plates. See figures next page.

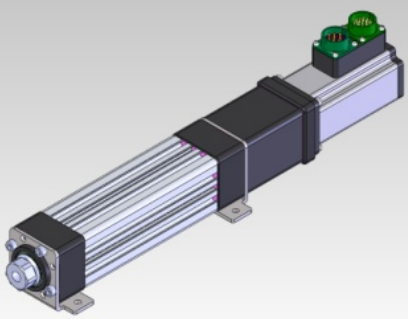
Mounting Configurations:



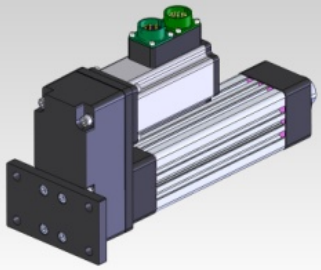
Eye Plate Mount



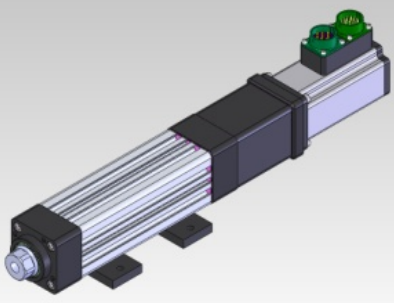
Trunnion Mount



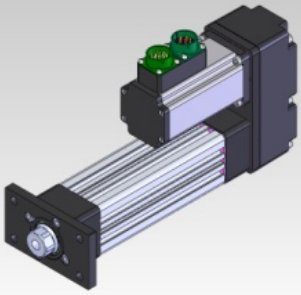
Angle Plate Mount



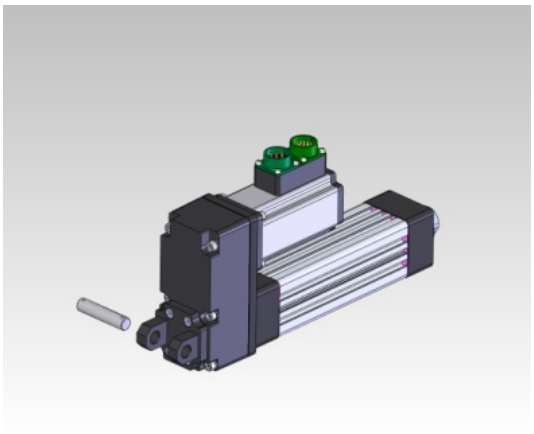
Rear Flange Plate Mount



Foot Plate Mount

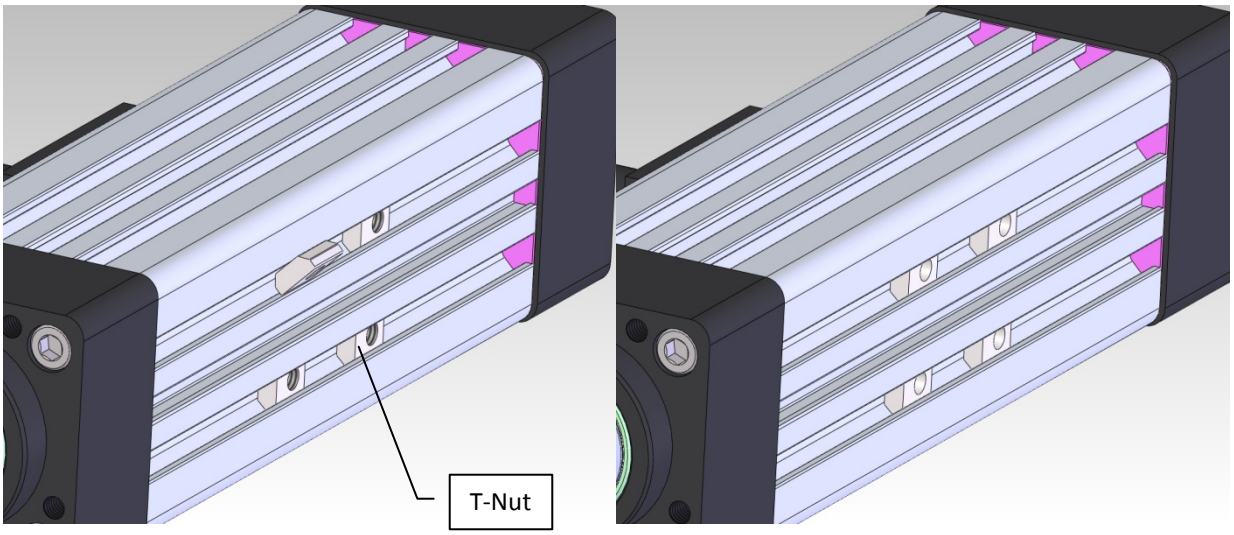


Front Flange Plate Mount

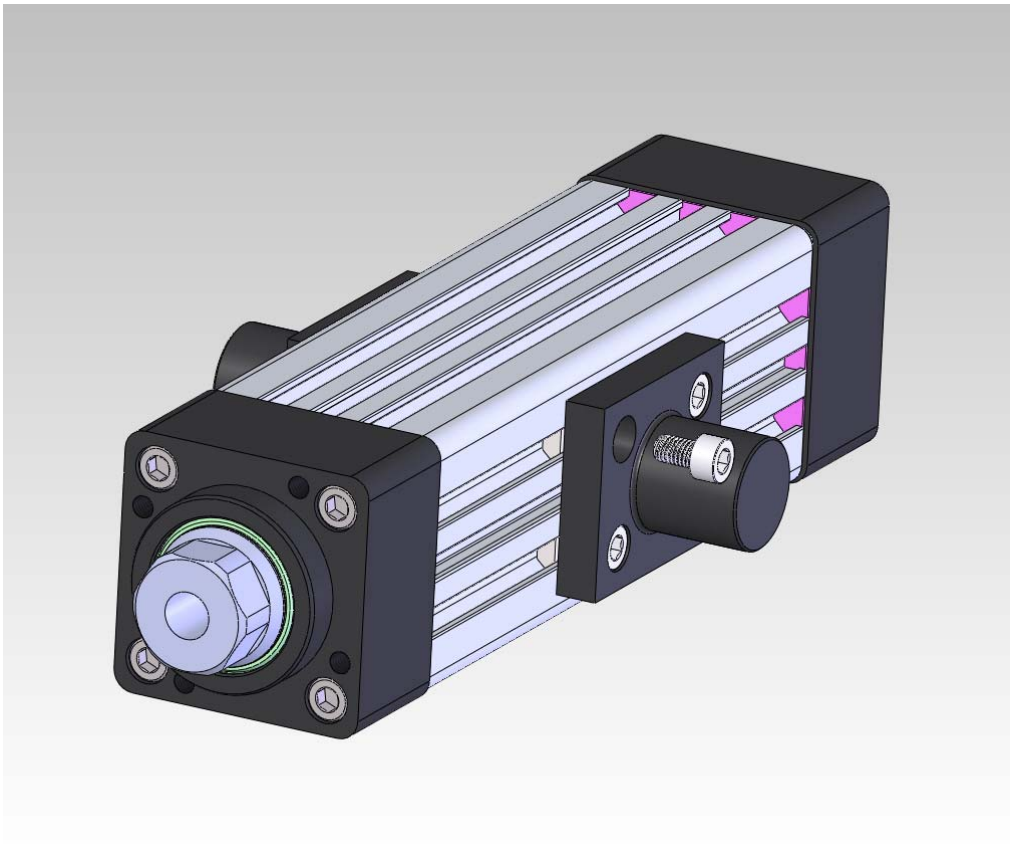


Clevis Plate Mount

2.2 Mounting Hardware Installation



Step 1: Insert T-nuts at an angle into the t-nut rail slot.



Step 2: Line up t-nut tapped holes with the trunnion mounting holes and insert and tighten screws. See Section 3.9 Fastener Torque Values.

2.3 Mounting Considerations

Care should be taken to mount the K Series actuator such that its linear travel is aligned with the travel of its load. Misalignment imparts direct side load on the actuator's extending rod. Side loading of the actuator's extending rod leads to accelerated seal wear, bearing wear and roller screw wear, and should be avoided.

Excessive side load on the output rod of the actuator may reduce the travel and seal life of the actuator.

T slot mounting hardware should be attached perpendicular to the axis of linear motion. All T-Nuts and associated flathead cap screws should be tightened to the appropriate torque level indicated in Section 3.9 Fastener Torque Values.

3.0 Maintenance & Service

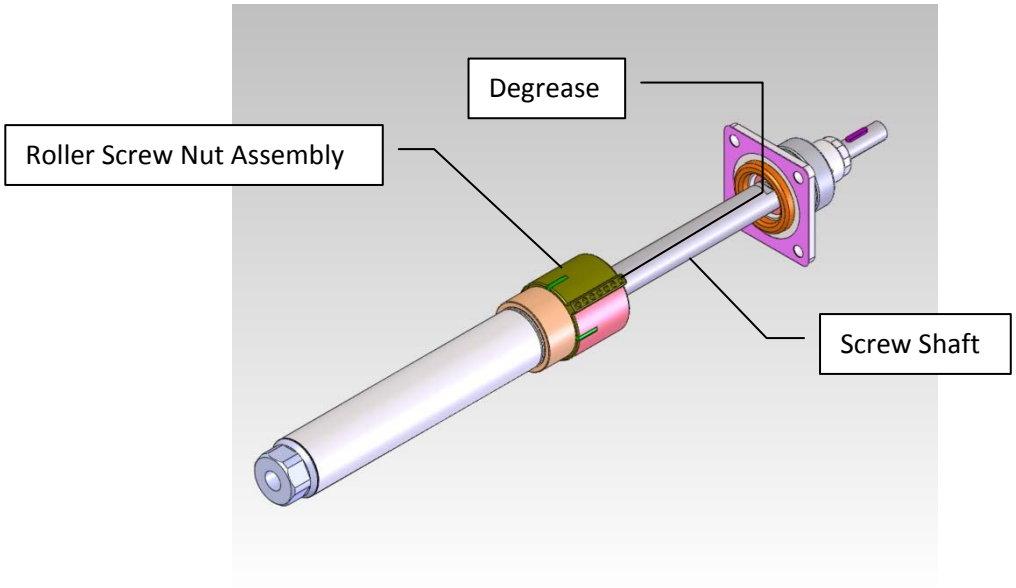
3.1 Roller Screw and Lubrication

The planetary roller screw used within the K Series actuators is a precision mechanism. Shock load and radial load should be avoided to provide maximum life from the actuator.

Extending or retracting the roller screw into the ends of travel may cause damage to the actuator or the other components of the application. See Section 3.6 End Of Stroke Cushions and Section 4.3 Limit Switches.

For roller screw life calculations and specifications see section 5.0.

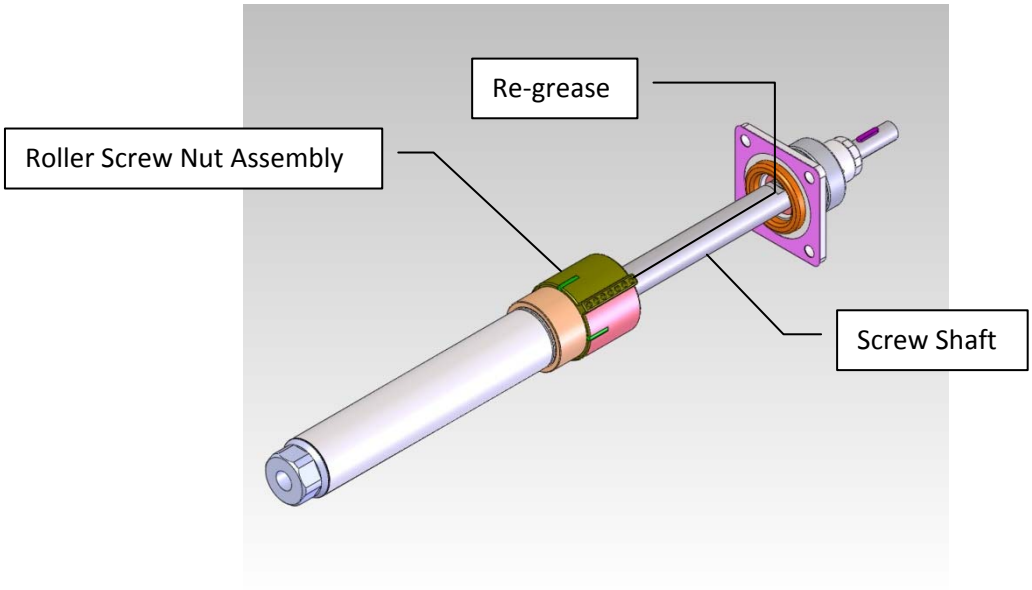
Degreasing - Extend the roller screw nut assembly to the end of the screw shaft. Using a brush and degreasing agent, remove all old grease from the roller screw shaft. See figure below. See Section 3.8 Disassembly & Reassembly Procedure.



Lubrication - The planetary roller screw shaft or acme screw shaft and nut assembly, anti-rotates, linear bearing, and rotary seal are factory lubricated. The anti-rotate and linear bearing does not need re-lubrication. If the roller screw shaft or acme screw shaft need re-lubrication follow the disassembly process for the actuator in Section 3.8 Disassembly & Reassembly Procedure.

Re-greasing - Extend the roller screw nut assembly to the end of the screw shaft. Apply a line of grease SHC220 Mobile Grease on the roller screw and smear it into the threads and wipe away the extra grease. Move the roller screw nut assembly back to the retract impact bumper plate in order to apply the new grease into the rollers of the roller screw nut assembly. Once the roller screw nut assembly has

been re-greased follow the assembly process for the actuator in Section 3.8 Disassembly & Reassembly Procedure. See figure below.



Take care to prevent foreign objects from entering the actuator or contaminating the grease.

Excessive grease is unnecessary and will increase the torque required to rotate the actuators roller screw.

3.2 Anti-Rotate Bearings

K Series actuators have internal anti-rotate bearings. The anti-rotate bearings travel in channels integral to the actuator case. Care should be taken when loading rod end attachments to not apply unnecessary torque to the anti-rotate bearings. The wrench flats on the end of the main rod should be used when attaching rod end accessories or load attachments. Below the anti-rotate bearings may be shims. There will be 2, 1, or none. The anti-rotate bearings also contain the magnets that are sensed by the limit switches. See Section 4.3 Limit Switches for more information on Limit Switches.

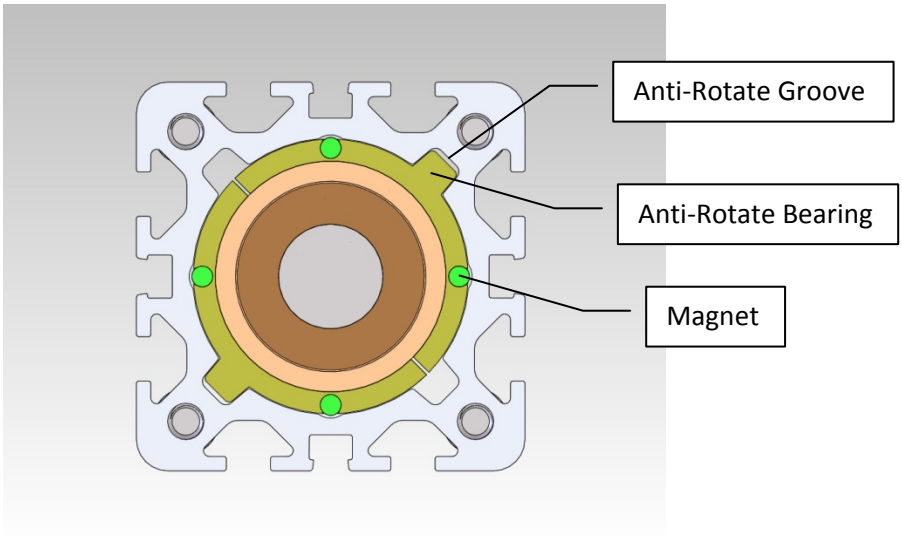


Figure: Anti-Rotate Bearings can be placed into the anti-rotate grooves using any orientation. See Actuator Reassembly in Section 3.8 Disassembly & Reassembly Procedure to see how shims play a role in orientating the Anti-Rotate Bearings into the anti-rotate grooves.

3.3 Seals

K Series actuators are all IP65 sealed using gaskets at the joints of the actuator housing components and a Buna o-ring at the end cap joint between the end cap and impact washer plate. The extending rod is sealed with a wiper. The input shaft is sealed either by the sealed deep groove ball bearings or the rotary shaft seal that is contained within the back end cap of the actuator, when angular contact bearings are used. These seals are lubricated on initial assembly and do not need to be lubricated again.

See Section 3.8 Disassembly & Reassembly Procedure for replacement of rod wipers, rotary shaft seals, O-rings or gaskets.

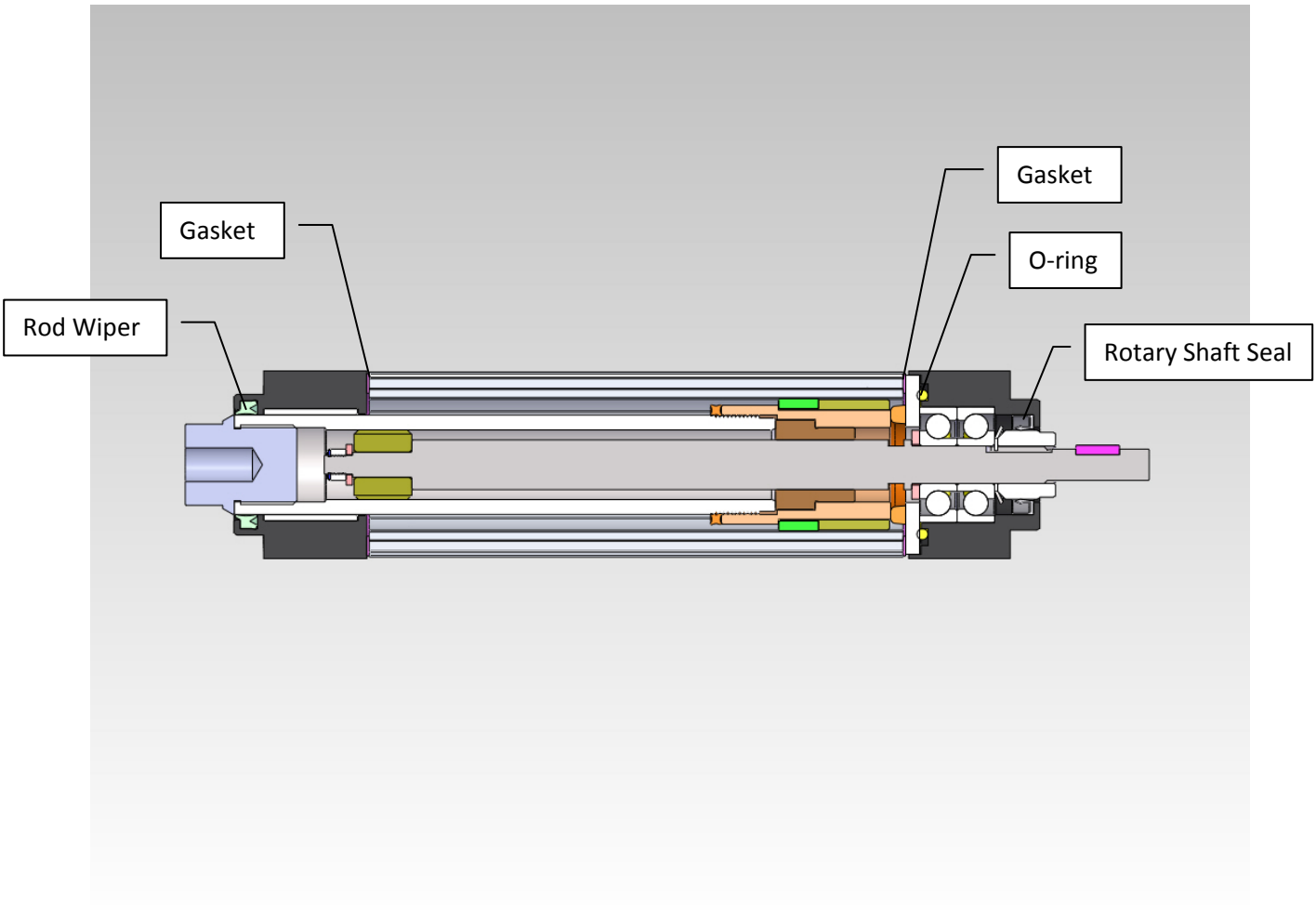


Figure: Base Unit Sealing Details

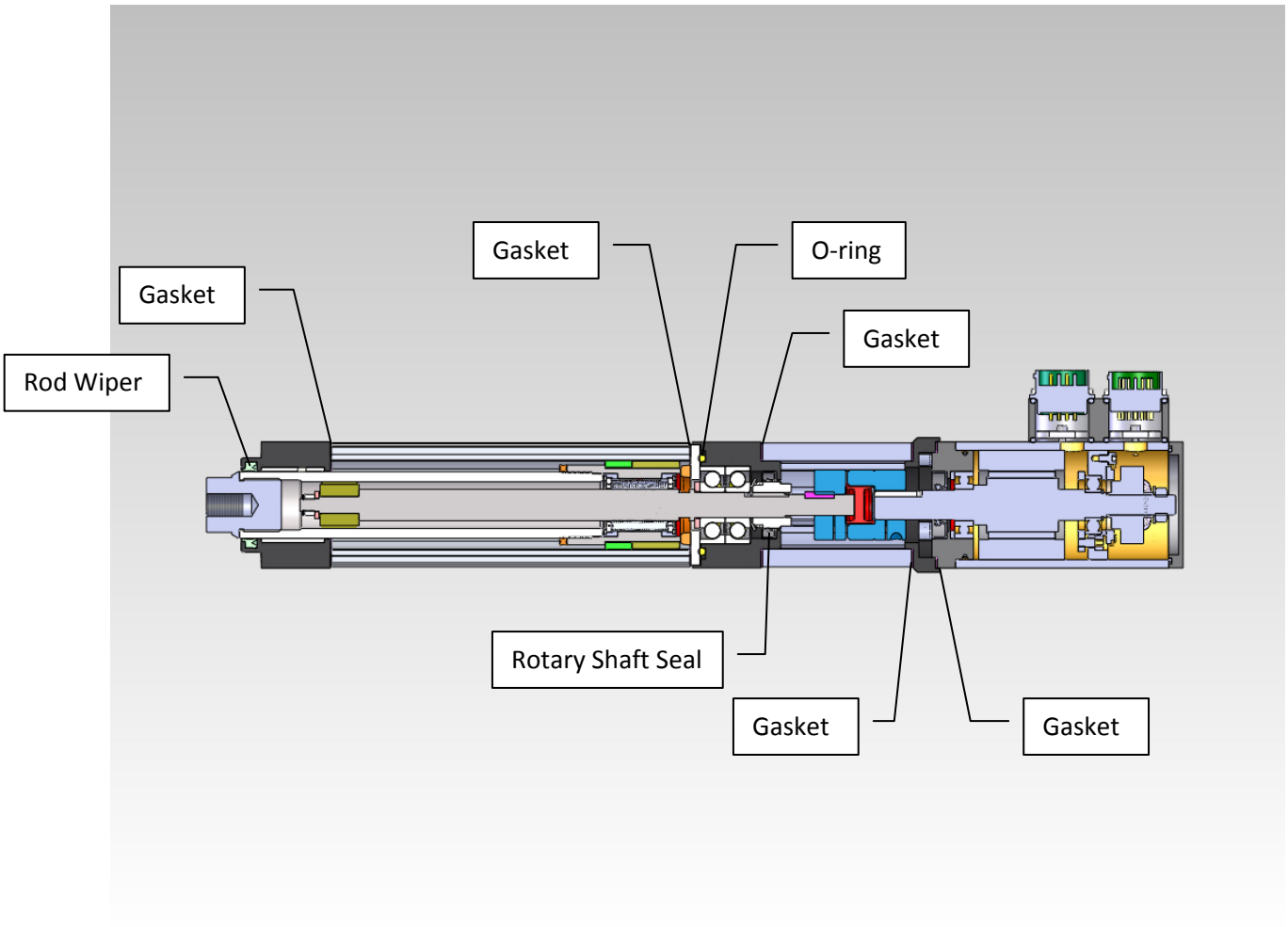


Figure: Inline Motor Mount Unit Sealing Details

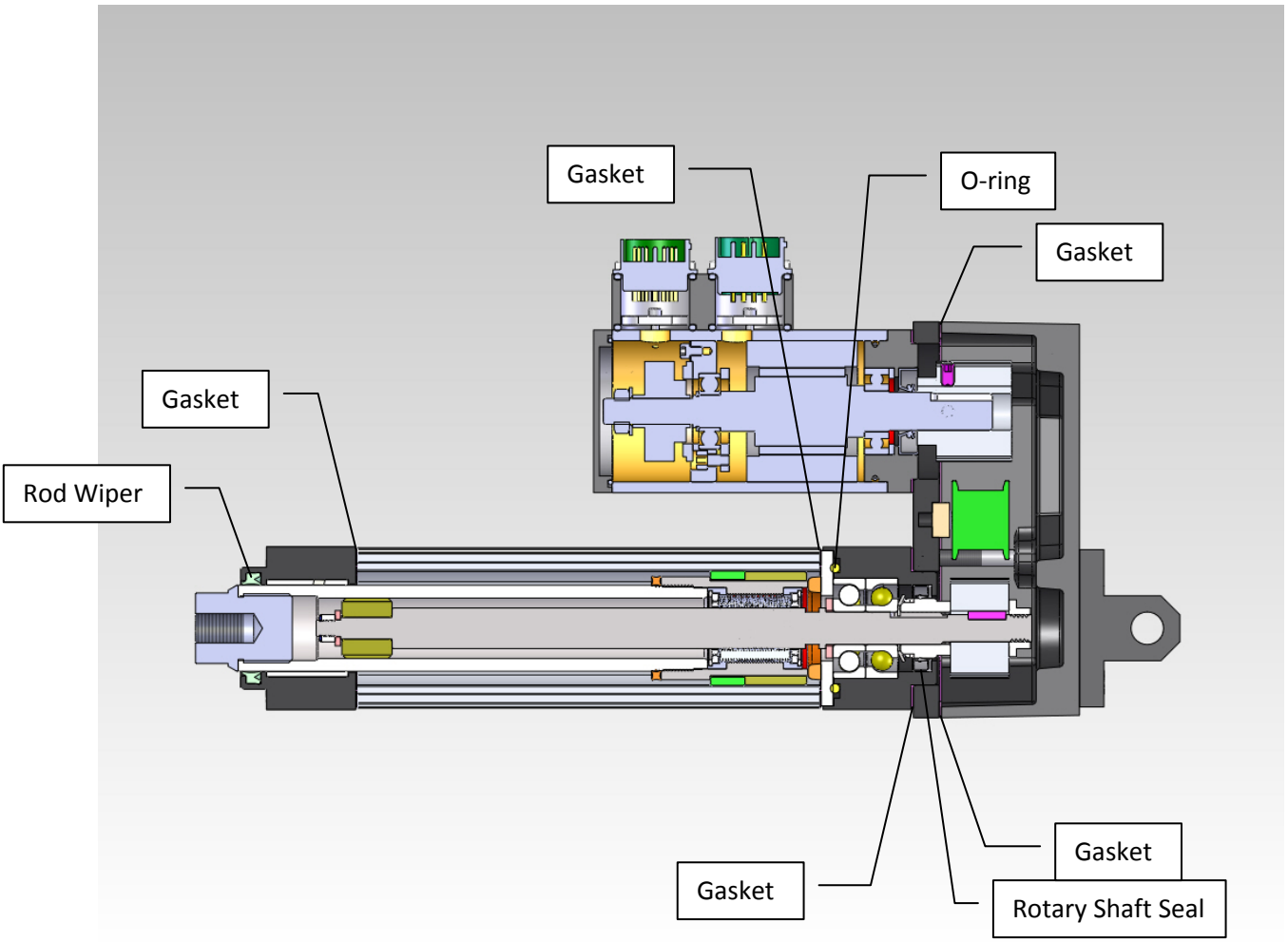


Figure: Parallel Motor Mount Unit Sealing Details

3.4 Thrust Bearings

KM, KA, and KX Series actuators use two deep groove ball bearings shown in Figure 8. KT Series actuators provide two angular contact bearings mounted in duplex arrangement shown in Figure 9. These bearings support the drive shaft within the K Series actuator. The inner races of the angular contact bearings are pre-loaded using a bearing jam nut and lock washer. The outer races are pre-loaded by the end cap and the impact washer plate. See Section 3.3 Seals to show how the actuator is sealed using the different bearing arrangements.

Bearing Replacement – see Section 3.8 Disassembly & Reassembly Procedure.

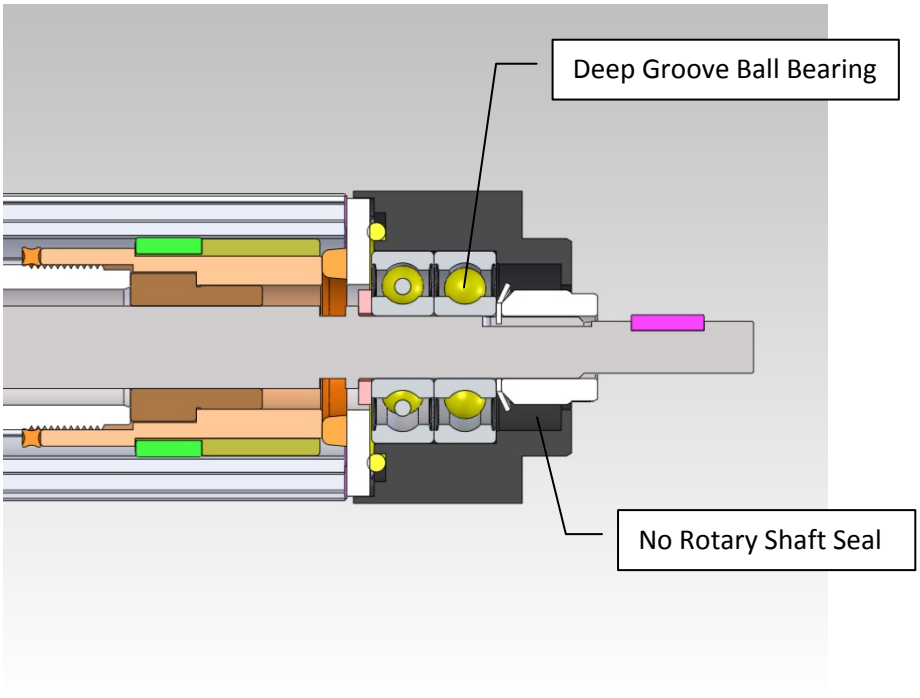


Figure: Roller Screw Support Using Deep Groove Ball Bearings

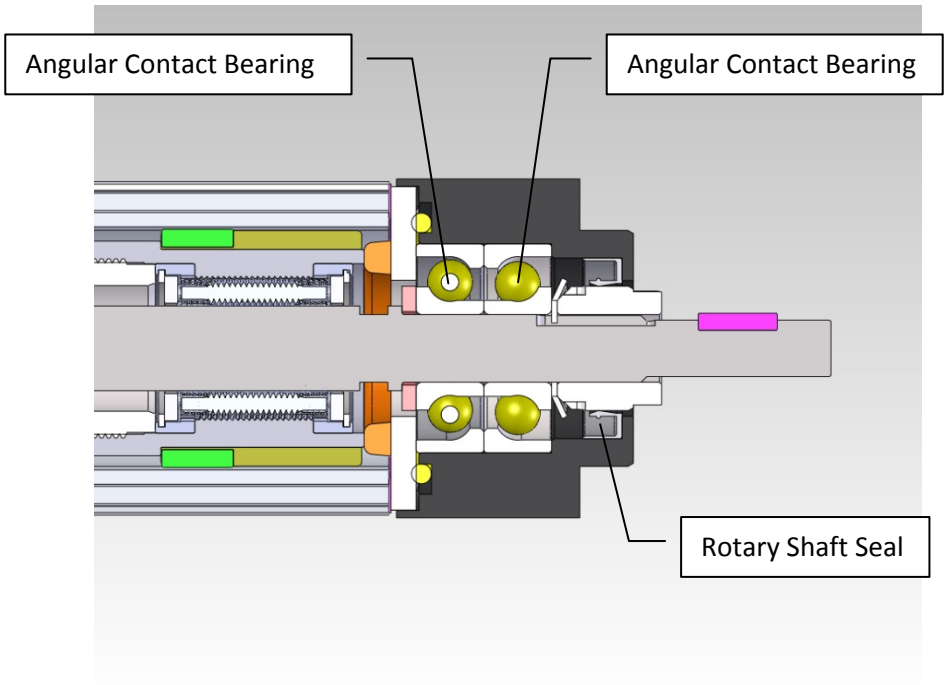


Figure: Roller Screw Support Using Angular Contact Bearings

3.5 Drive Train

Parallel Drive

The parallel motor mount option for the K Series actuators provides a fiberglass reinforced timing belt and pulley drive train to transmit the motors rotation and torque to the actuator's roller screw mechanism. The drive train does not require lubrication. The belt and pulley transmission is in a protective housing to help prevent contamination by dirt and debris. The belt housing and cover should be kept in place at all times during operation and should only be removed for motor mounting and drive train inspection. The belt and pulley system should be inspected periodically for wear and proper tensioning.

Removing the protective housing from the belt and pulley drive train during operation of the actuator may cause damage to the actuator components or severe injury. Power should be removed and locked out from the actuators motor at any time the protective drive train cover is removed. Failure to do so can result in damage to the actuator or cause serious injury.

Improper belt tension can cause premature belt wear and failure, belt noise and slippage. The following picture is an example of a typical belt and pulley drive train in a K Series actuator. Actual drive trains will vary in configuration depending on exact actuator and motor configuration. Contact Exlar application engineers with any questions regarding the installation or maintenance of the belt and pulley drive train on your K Series Actuator.

Timing Belt Replacement - see Section 3.8 Disassembly & Reassembly Procedure.

Pulley Replacement – see Section 3.8 Disassembly & Reassembly Procedure.

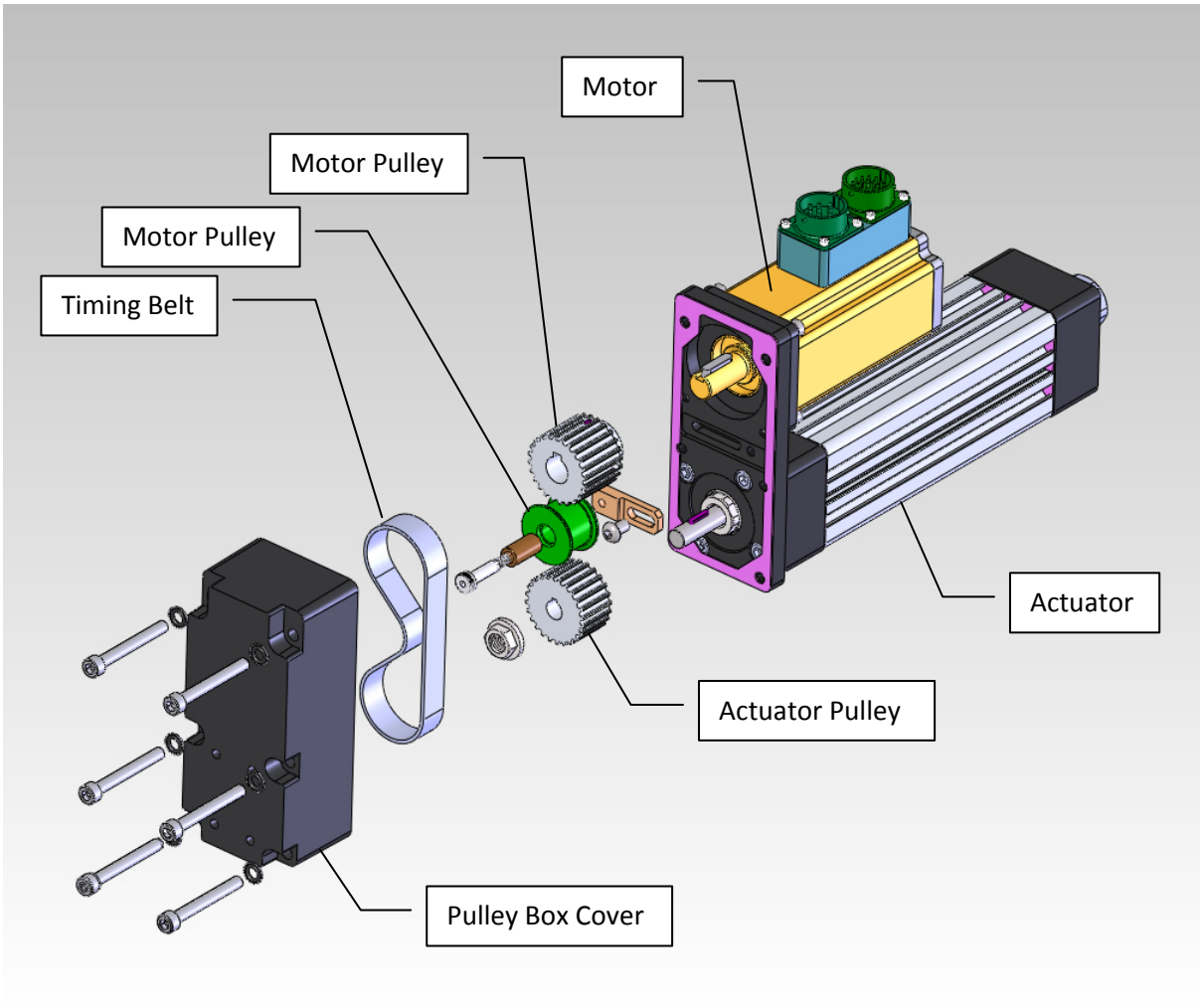


Figure: Parallel Motor Mount Drive Train Assembly

Inline Drive

The inline motor mounting configuration uses a coupling, attaching the motors output shaft to the actuators input shaft.

Spider Coupling and Components Replacement - see Section 3.8 Disassembly & Reassembly Procedure.

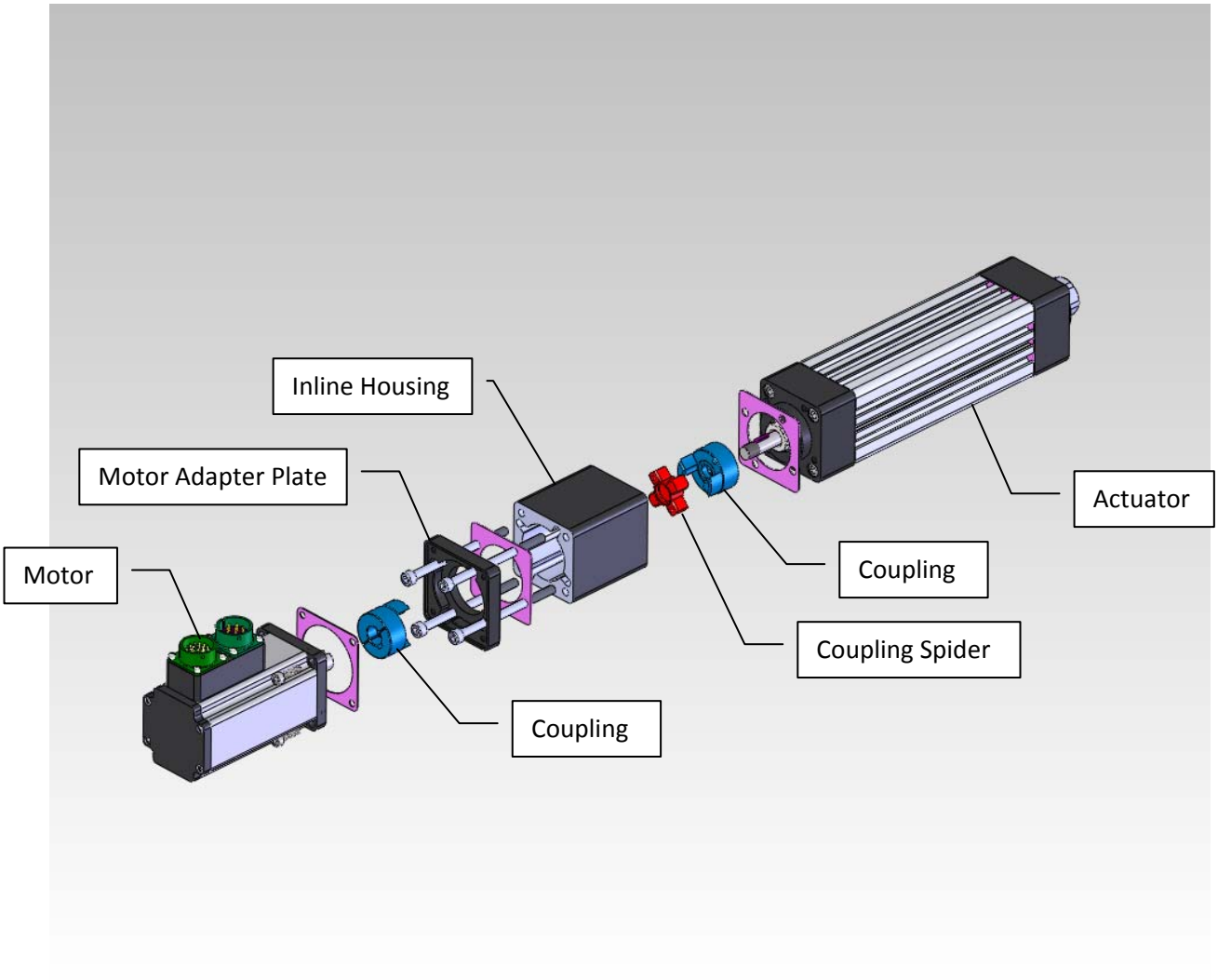


Figure: Inline Motor Mount Drive Train Assembly

3.6 End Of Stroke Cushions

Every standard K Series actuator is equipped with rubber impact bumpers, which are designed to protect the actuator from accidental over extension or retraction.

End of stroke cushions are provided for fail safe only and should not be used as an application limit of stroke.

K Series actuators are designed with an additional 10mm of length over nominal stroke. This is to allow users to utilize the full nominal stroke without causing damage by end crashing. See figures on pages 22-24 for information on stroke limits and how to position limit switches. See Section 4.3 Limit Switches.

Extend Impact Bumper Replacement – see Section 3.8 Disassembly & Reassembly Procedure.

Retract Impact Bumper Plate Replacement – see Section 3.8 Disassembly & Reassembly Procedure.

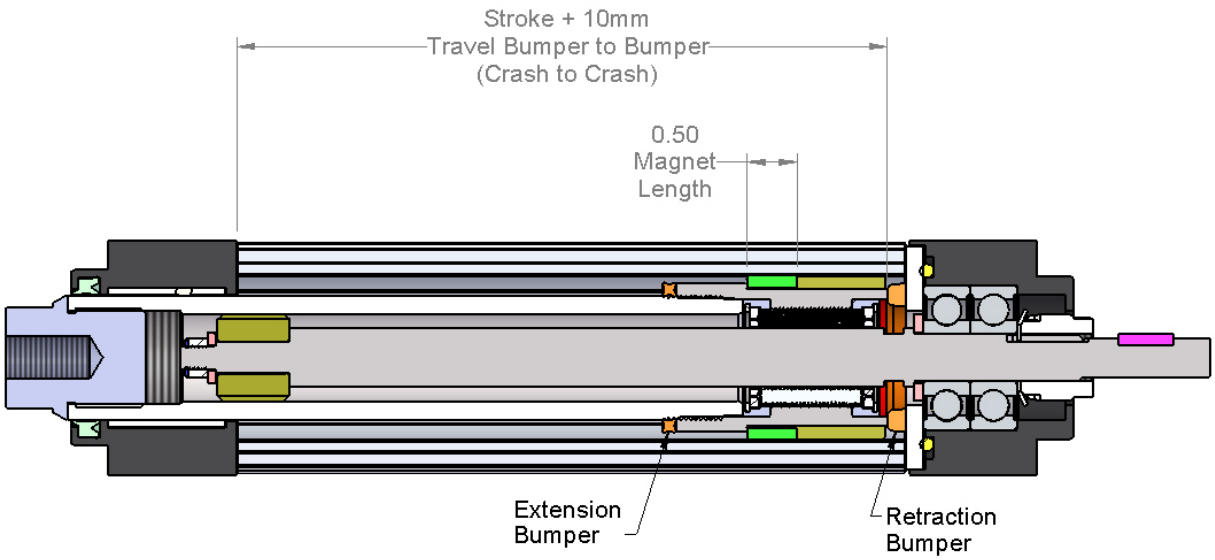


Figure: Actuator Shown in fully retracted "crash" position, with contact on the Retraction Bumper

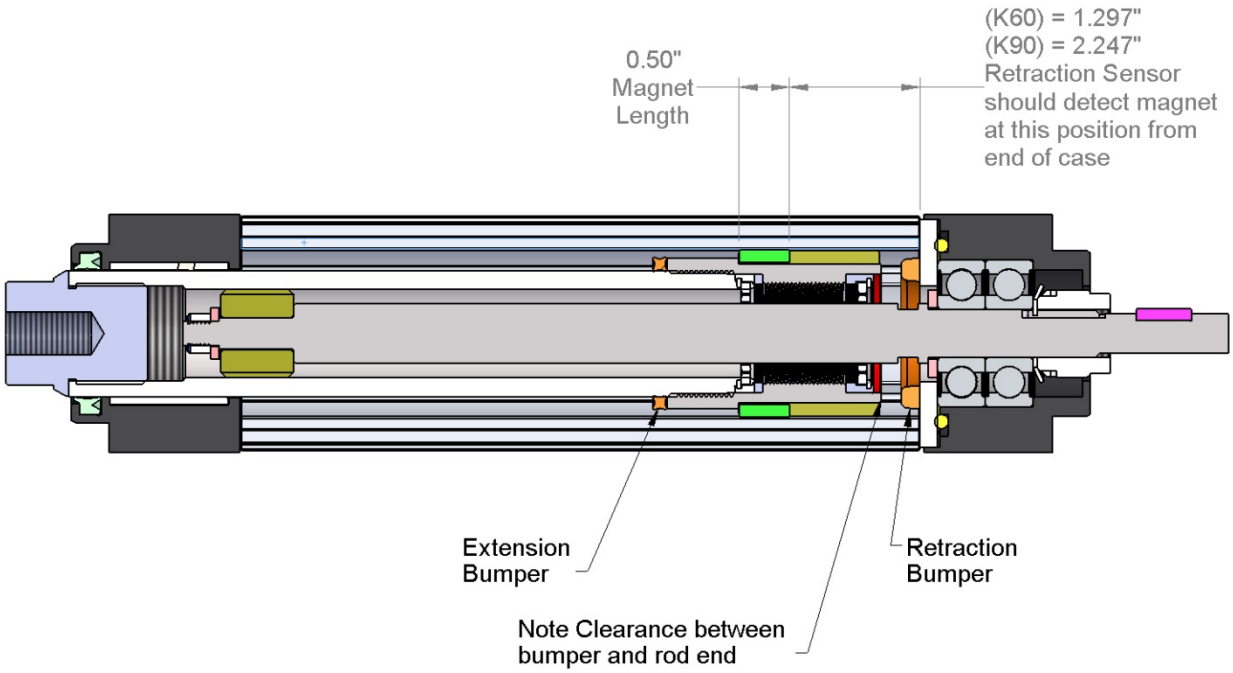


Figure: Actuator Shown in maximum recommended retract position, with 5mm of clearance on retract impact bumper.

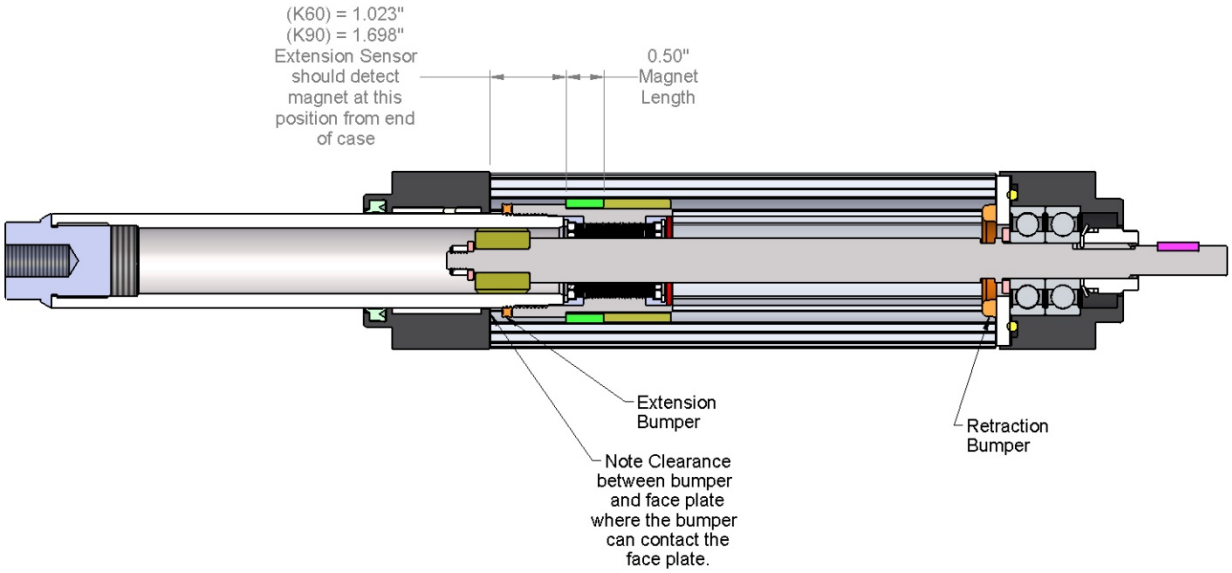
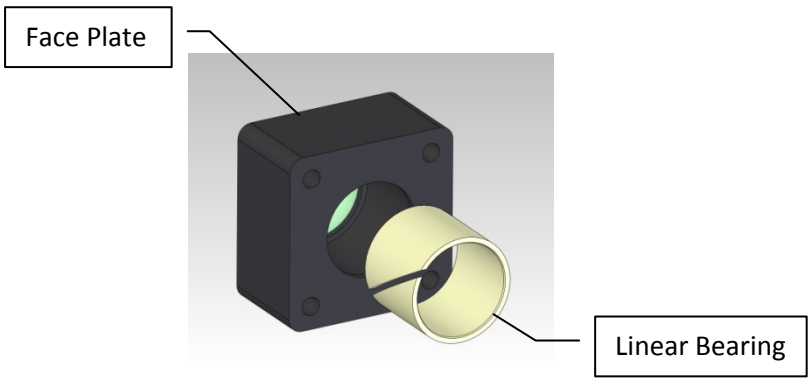

(K60) = 1.023"
(K90) = 1.698"
Extension Sensor should detect magnet at this position from end of case
0.50" Magnet Length
Extension Bumper
Retraction Bumper
Note Clearance between bumper and face plate where the bumper can contact the face plate.

Figure: Actuator shown in maximum recommended extension position, with 5mm of clearance on extend impact bumper.

3.7 Linear Bearing

Every standard K Series actuator is equipped with a linear bearing, which is designed to guide the main rod in a linear motion. The linear bearing will not need to be replaced on a regular basis, but if it should become damaged or excessively worn, it can be replaced. See figure below.

Linear Bearing Replacement – see Section 3.8 Disassembly & Reassembly Procedure.



3.8 Disassembly & Reassembly Procedure

The general disassembly and reassembly procedures are general guidelines. Individual designs may differ from these procedures and any questions should be verified with Exlar before reassembling and

reinstalling the actuator into your machine or application. For both procedures refer to the drawings included in the disassembly procedure for reference only. For torque values see chart in Section 3.9.

Parallel Motor and Actuator Dismounting

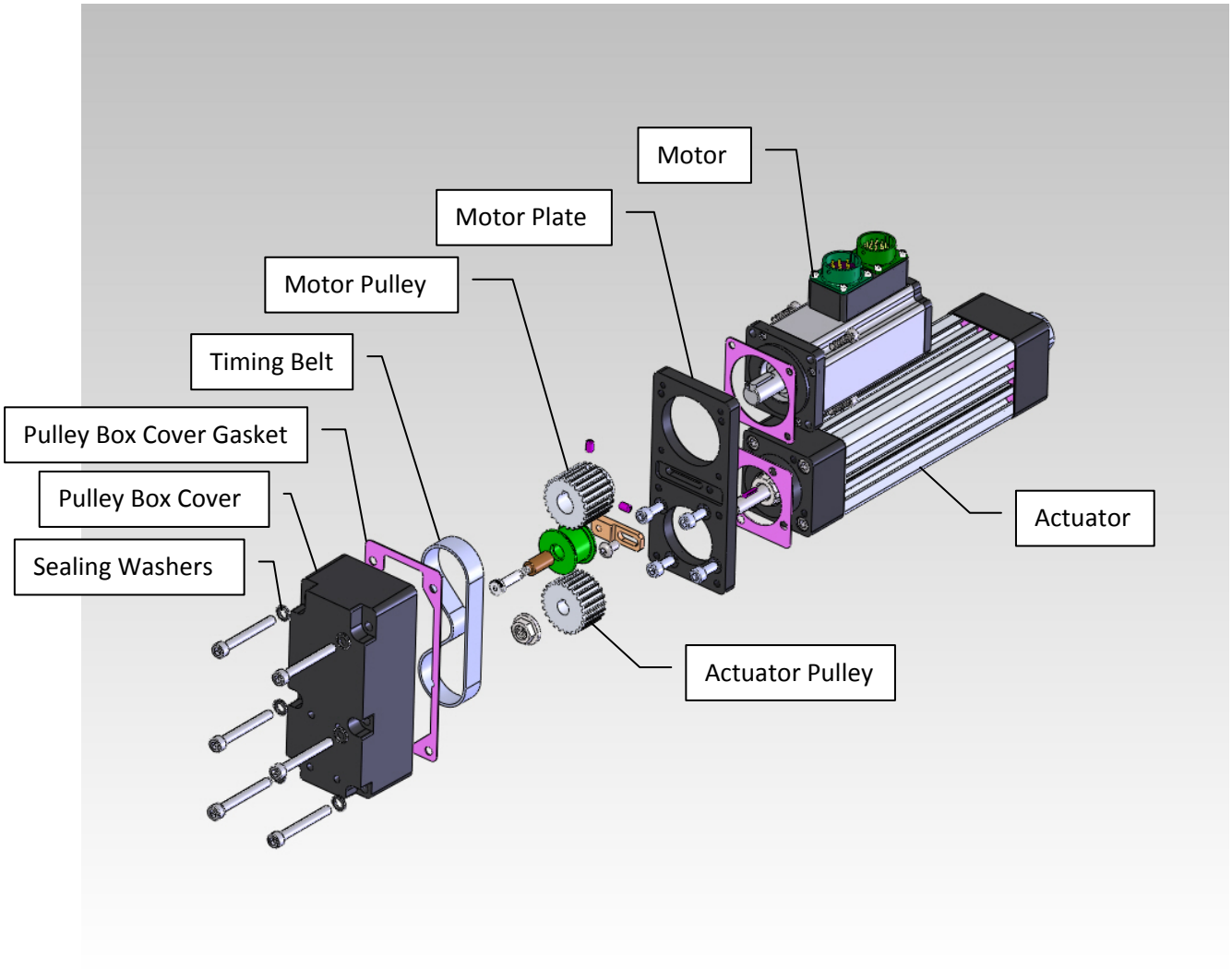


Figure: Parallel Motor Mount Drive Train Assembly

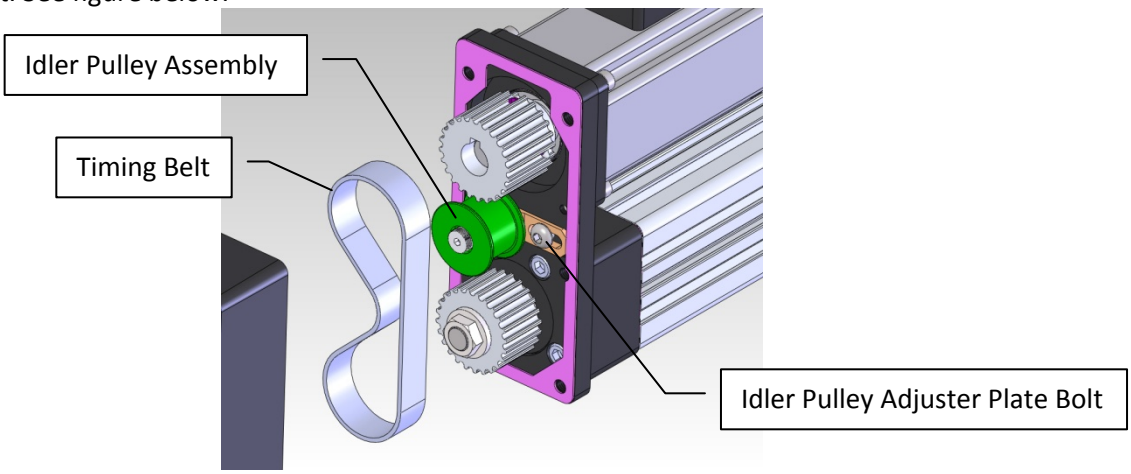
1.) Remove power.

2.) Dismount the actuator from the application if necessary.

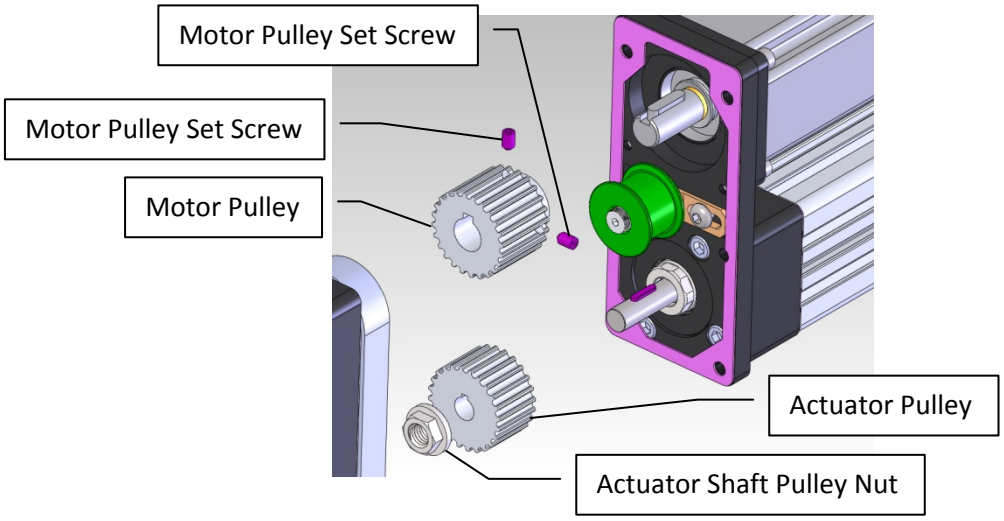
3.) Remove pulley box cover by removing cover screws and sealing washers and pulling cover away from the motor plate.

4.) Remove pulley box cover gasket.

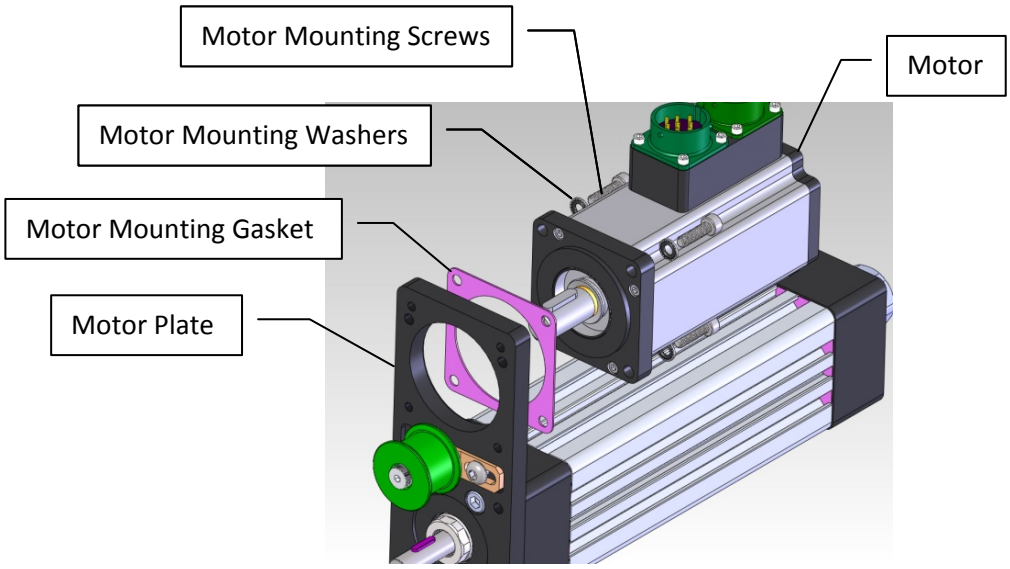
5.) Loosen the idler pulley adjuster plate bolt and slide idler pulley assembly to the left and remove the belt. See figure below.



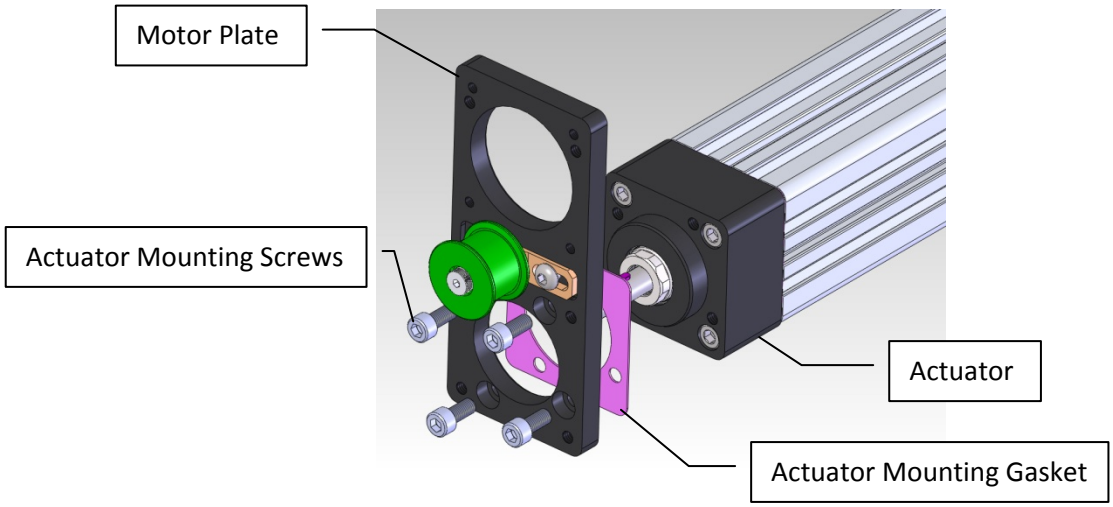
6.) Loosen the set screws on motor pulley and slide the pulley off the shaft. Clamp the actuator shaft pulley and loosen actuator shaft pulley nut and remove. Slide the pulley off the actuator shaft. Take care not to lose the keys for each shaft. See figure below.



7.) Remove the motor mounting screws and washers and remove motor and gasket. See figure below.



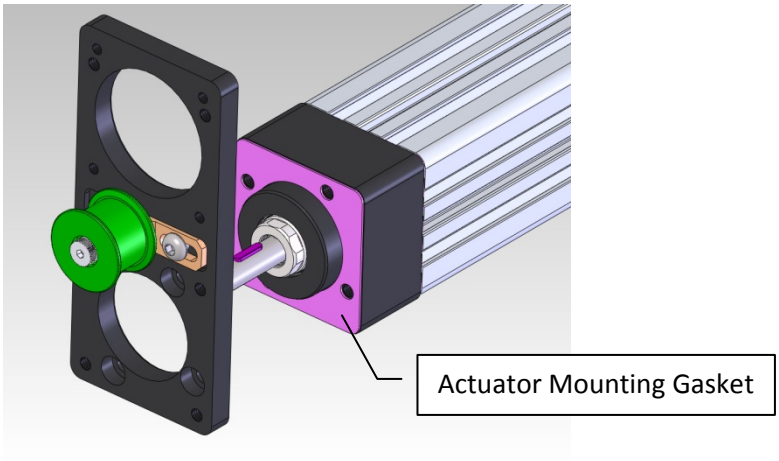
8.) Remove the actuator mounting screws and remove actuator and gasket. See figure below.



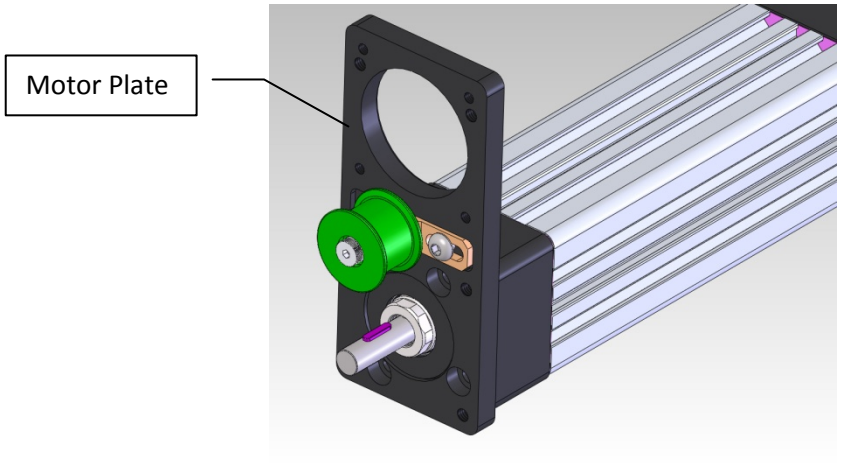
9.) Proceed to the section on Actuator Disassembly.

Parallel Motor and Actuator Mounting

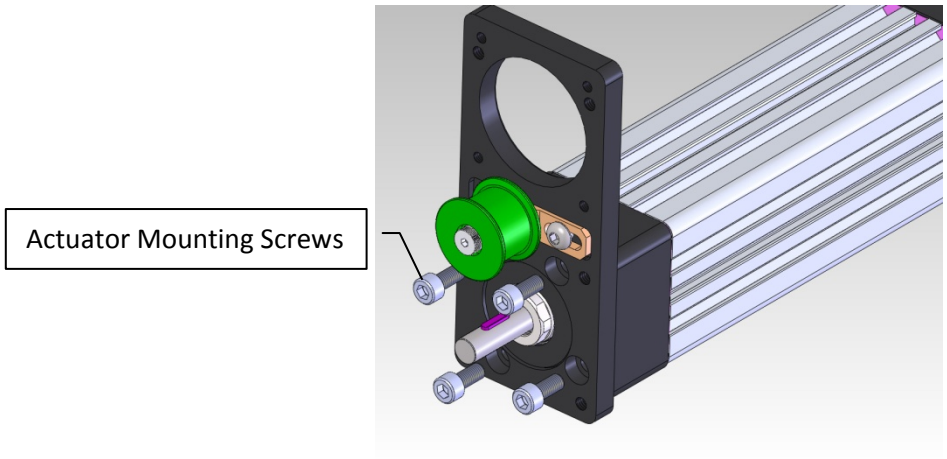
1.) Place the actuator gasket over the pilot diameter of the actuator face plate so it is flush with the face of the end cap. See figure below.



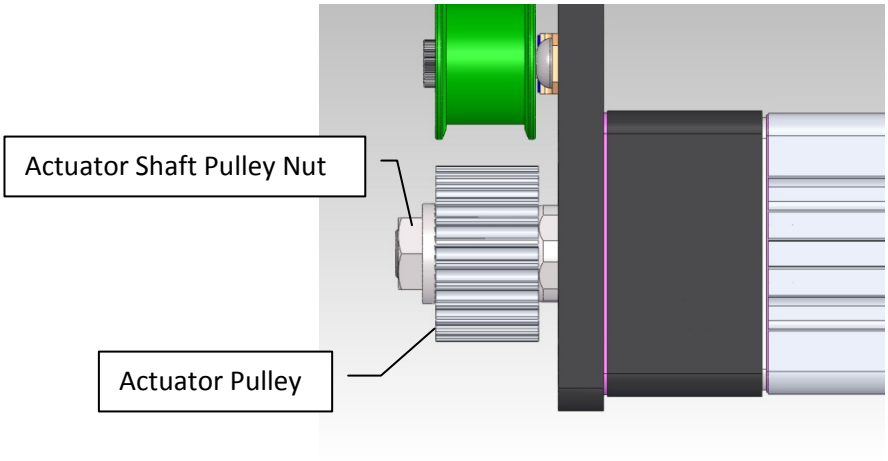
2.) Place the actuator input shaft through the actuator hole on the motor plate until the actuator gasket and actuator face plate are flush against the motor plate pilot face. See figure below.



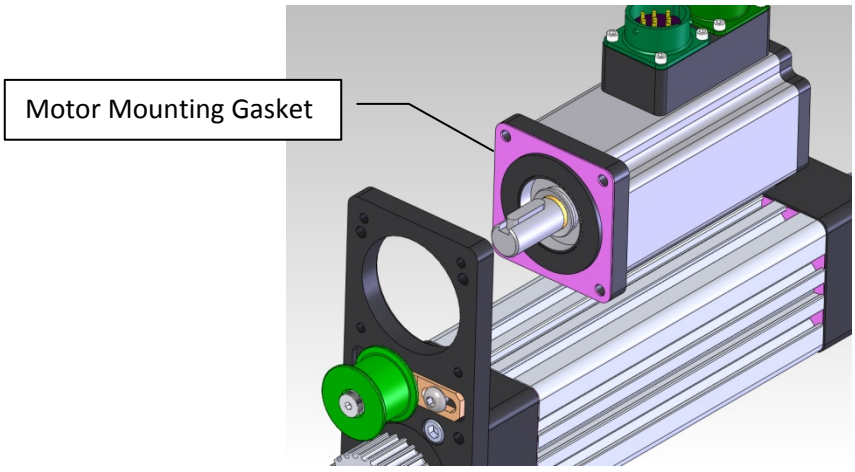
3.) Insert actuator screws and tighten to the designated torque value. See Section 3.9 Fastener Torque Values. See figure below.



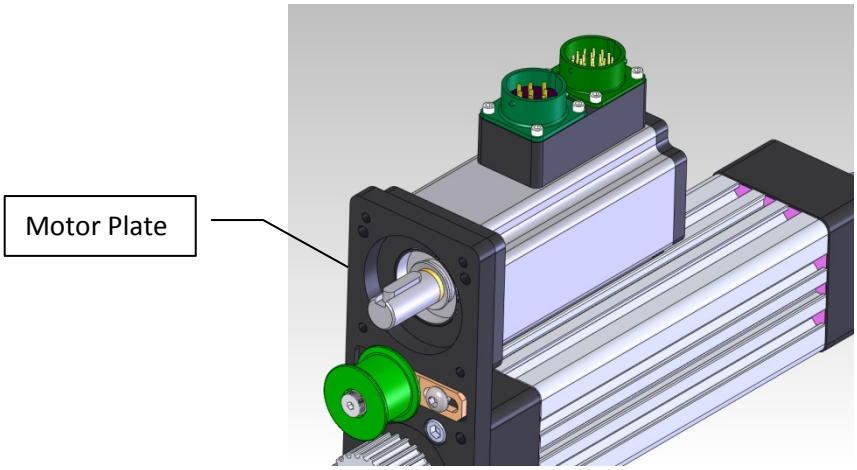
4.) Place the key in the actuator shaft keyway. Clamp the actuator shaft pulley and tighten the actuator shaft pulley nut. See Section 3.9 Fastener Torque Values. See figure below.



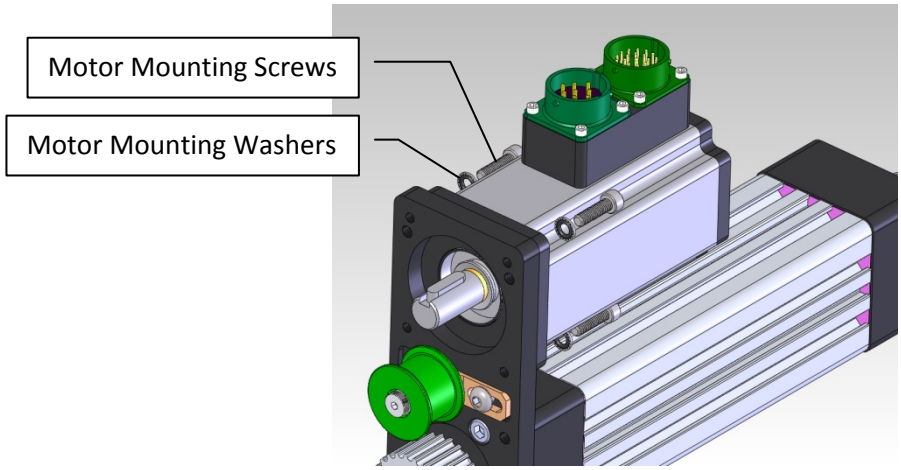
5.) Place the motor gasket over the pilot diameter of the motor face plate so it is flush with the face of the end cap. See figure below.



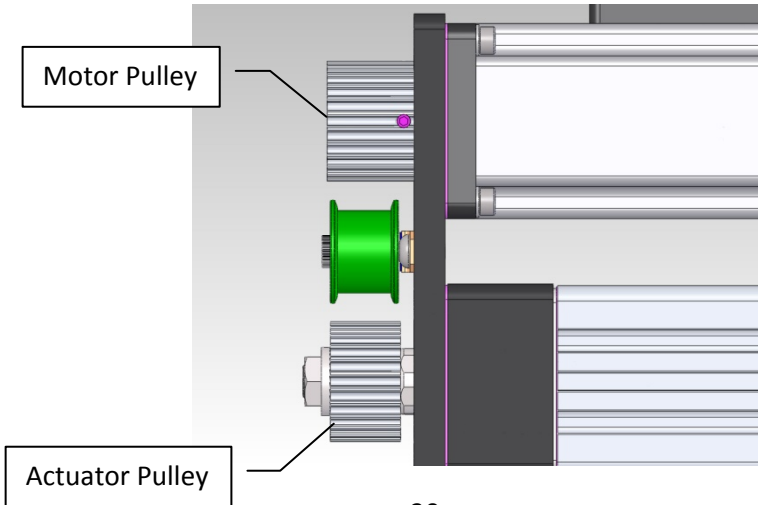
6.) Place the motor output shaft through the output shaft hole on the motor plate until the motor gasket and motor face plate face are flush against the motor plate pilot face. See figure next page.



7.) Insert motor washers and screws and tighten to the designated torque value. See Section 3.9 Fastener Torque Values. See figure below.



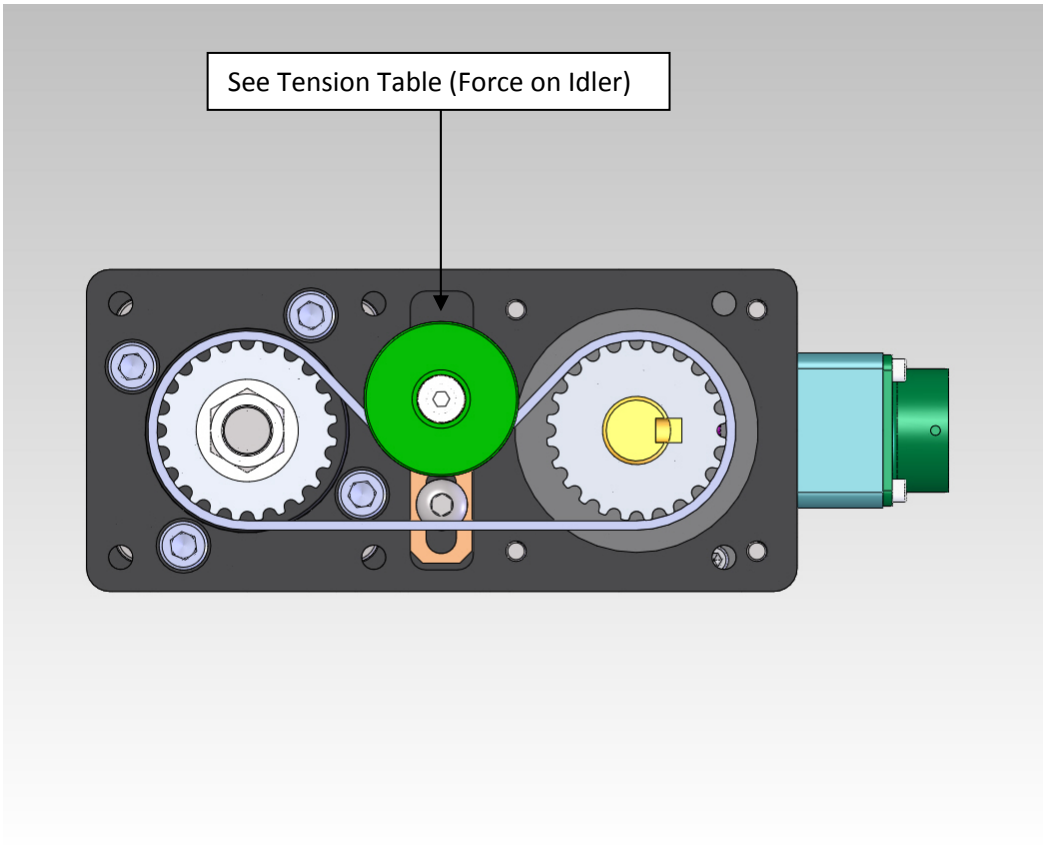
8.) Place the key in the motor shaft keyway. Slide the pulley on and align it with the screw shaft pulley. Once aligned, torque the pulley set screws. See Section 3.9 Torque Values. See figure below.



9.) Install and tension timing belt. See Belt Tensioning below.

Belt Tensioning

Proper Belt Tension



The idler pulley plate slot allows moving the idler pulley so the belt can be placed, followed by placing a force directly over the idler pulley to obtain the proper tension to tighten the belt (See table next page).

The standard K Series timing belt is a GT2, 5mm pitch that comes in various lengths depending on the configuration (See table next page).

Belt Tension Table

K60					
Motor	Ratio	Max Cont. Torque	Max Speed	Tension Required	Force on Idler
SLM 60*	1:1	15 in-lbs	5000 RPM	9.18 lb	12 lb (53N)
SLG 60*	1:1	53 in-lbs	1000 RPM	28.65 lb	36 lb (160N)
NEMA 23	1:1	6 in-lbs	5000 RPM	8.4 lb	10 lb (53N)
SLG 60*	1:1	70 in-lbs	1000 RPM	30.34 lb	27 lb (120N)
SLM 60*	1.5:1	15 in-lbs	5000 RPM	9.18 lb	12 lb (53N)
NEMA 23	1.5:1	6 in-lbs	5000 RPM	8.4 lb	11 lb (58N)
SLM 90*	1:1	40 in-lbs	4000 RPM	15.96 lb	14 lb (62N)
NEMA 34	1:1	30 in-lbs	4000 RPM	12.36 lb	12 lb (53N)
SLM 60*	2:1	15 in-lbs	5000 RPM	9.18 lb	12 lb (53N)
NEMA 23	2:1	6 in-lbs	5000 RPM	8.4 lb	11 lb (58N)
NEMA 34	2:1	30 in-lbs	4000 RPM	16.89 lb	22 lb (98N)
* Same tension is required for Tritex motors and gearmotors of equivalent size					

K90					
Motor	Ratio	Max Cont. Torque	Max Speed	Tension Required	Force on Idler
SLM 90*	1:1	53 in-lbs	4000 RPM	32.18 lb	38 lb (169N)
NEMA 34	1:1	15 in-lbs	4000 RPM	14.1 lb	17 lb (76N)
SLG 90*	1:1	137 in-lbs	1000 RPM	73.81 lb	99 lb (440N)
SLG 60 10:1*	1:1	137 in-lbs	500 RPM	82.85 lb	109 lb (485N)
SLG 60 5:1*	1:1	75 in-lbs	1000 RPM	45.47 lb	60 lb (267N)
SLM 115*	1:1	137 in-lbs	3000 RPM	62.46 lb	79 lb (351N)
NEMA 34	2:1	15 in-lbs	4000 RPM	14.1 lb	16 lb (71N)
SLM 90*	2:1	53 in-lbs	4000 RPM	35.04 lb	39 lb (174N)
SLG 90*	2:1	70 in-lbs	1000 RPM	43.83 lb	49 lb (218N)
* Same tension is required for Tritex motors and gearmotors of equivalent size					

Belt Size Table

K60			
Motor	**Ratio**	**Belt Length**	**Width**
M60*	1:1	(60 T) 47053	15mm
N23	1:1	(60 T) 50980	9mm
N23	1.5:1	(71 T) 51043	9mm
M60*	1.5:1	(71 T) 49051	15mm
N34	1:1	(83 T) 52280	15mm
M90*	1:1	(83 T) 52280	15mm
N23	2:1	(85 T) 51044	9mm
N34	2:1	(85 T) 49052	15mm
M60*	2:1	(85 T) 49052	15mm
M90*	2:1	(85 T) 49052	15mm
* Same belt is required for Tritex motors and gearmotors of equivalent size			

K90			
Motor	**Ratio**	**Belt Length**	**Width**
M60*	1:1	(81 T) 51686	25mm
M90*	1:1	(85 T) 51475	25mm
N34	1:1	(85 T) 49205	15mm
M115*	1:1	(108 T) 52047	25mm
M60*	2:1	(110 T) 52048	25mm
M90*	2:1	(110 T) 52048	25mm
N34	2:1	(110 T) 52140	15mm
* Same belt is required for Tritex motors and gearmotors of equivalent size			

Inline Motor and Actuator Dismounting

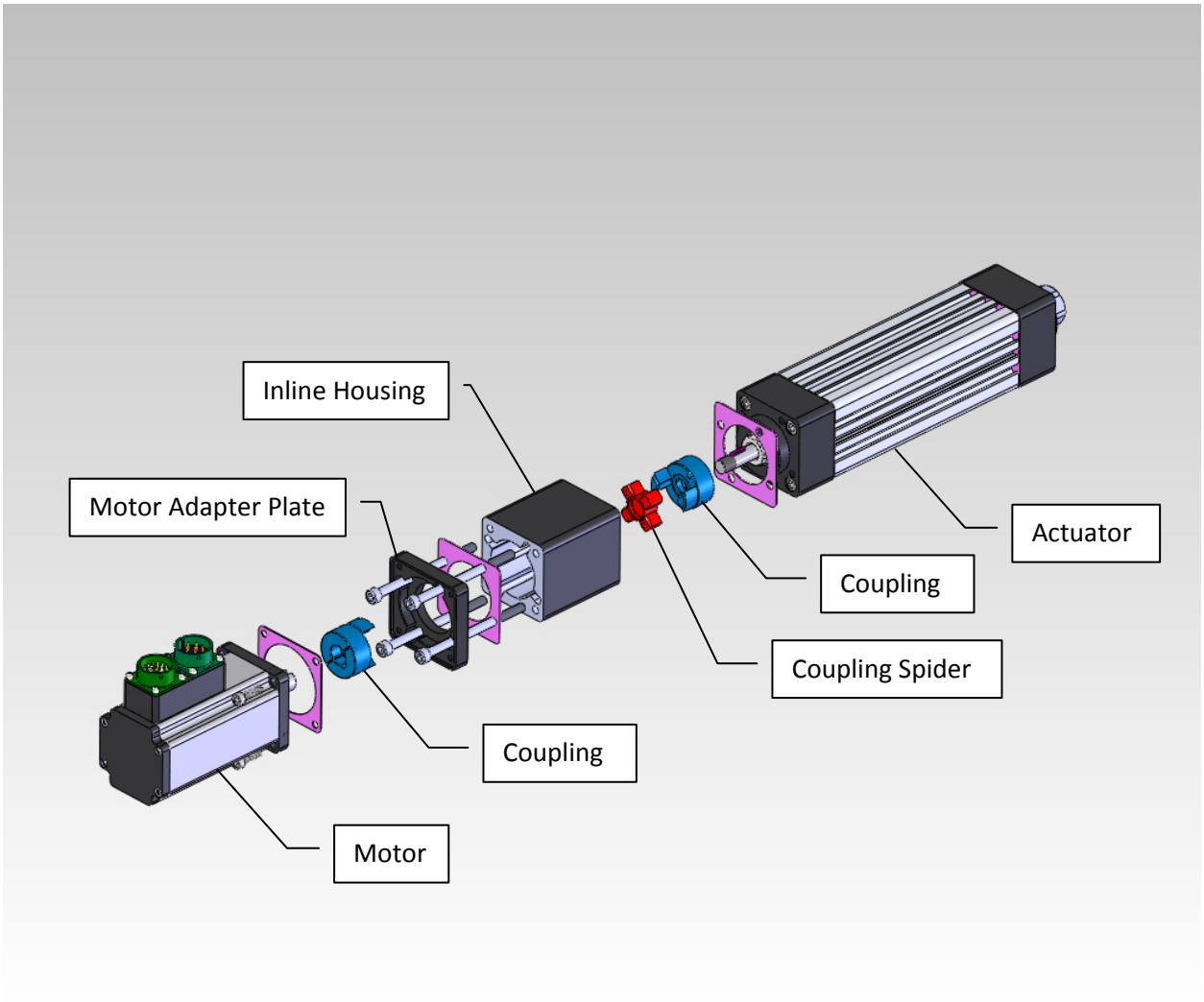
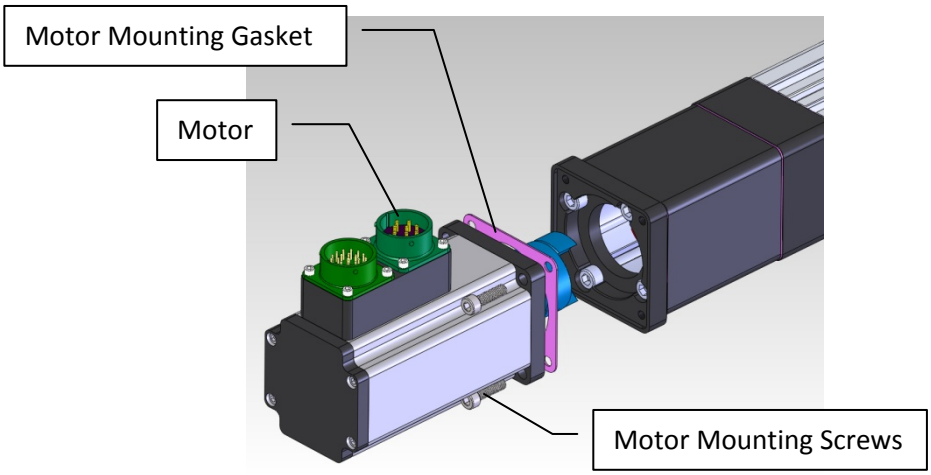


Figure 12: Inline Motor Mount Disassembly

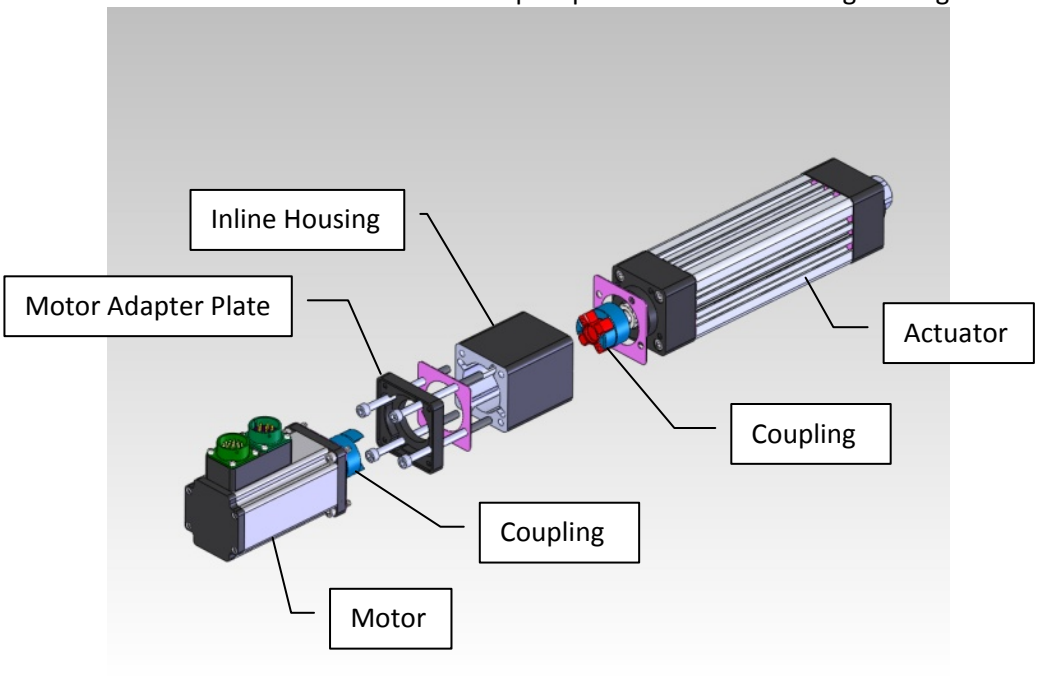
1.) Remove power.

2.) Dismount the actuator from the application if necessary.

3.) Loosen and remove motor screws. Remove motor from actuator by pulling motor in the opposite direction of actuator until the coupling separates. See figure next page.



4.) Loosen and remove screws from the motor adapter plate and inline housing. See figure below.



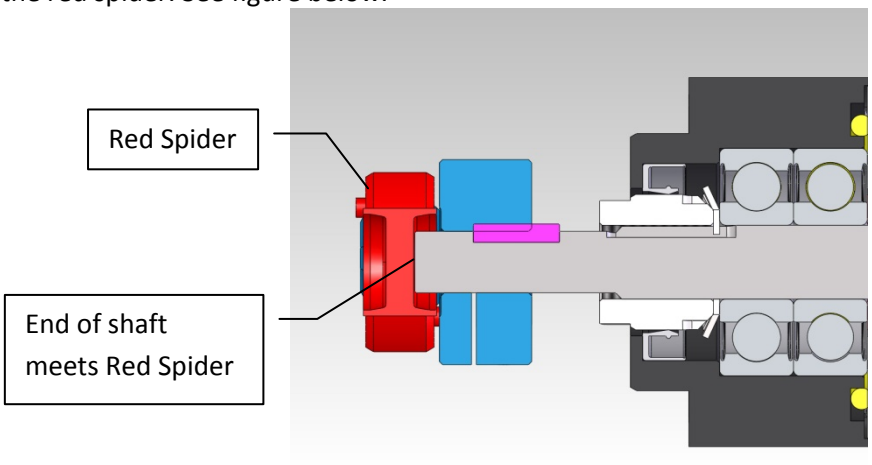
5.) Loosen clamping screw for each coupling and slide coupling off the shafts. It is not required to remove the couplings from the shafts unless further work will be done with the motor or actuator. Take care not to lose the keys for each shaft.

6.) Proceed to the section on Actuator Disassembly.

Inline Motor and Actuator Mounting

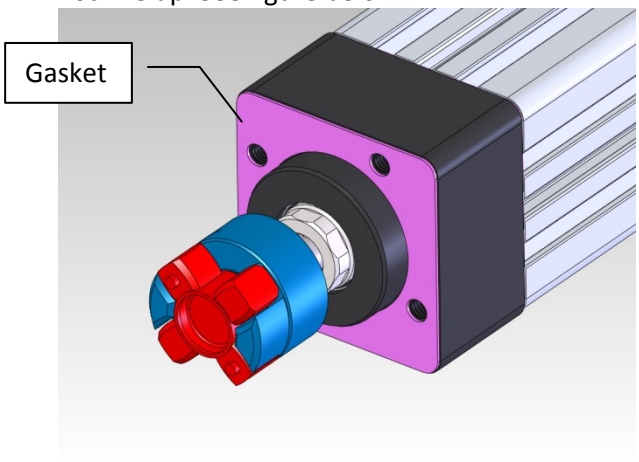
1.) Place the key in the keyway of the roller screw at the input end.

2.) Slide the coupling onto the input shaft of the roller screw shaft until the end of the shaft touches the red spider. See figure below.

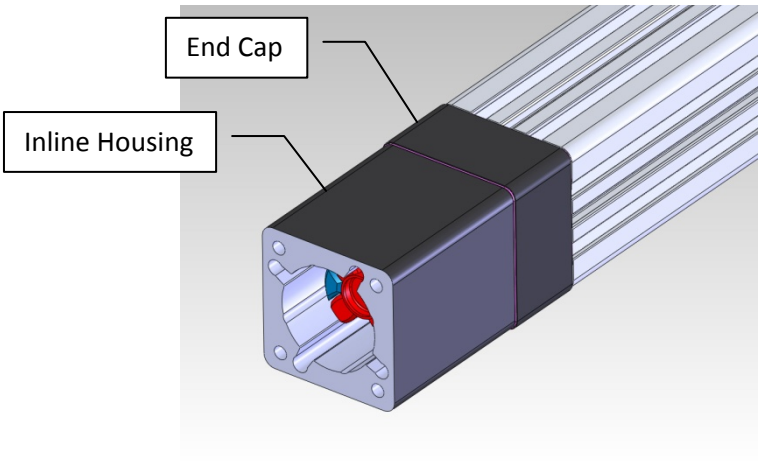


3.) Torque the coupling clamp screw. See Section 3.9 Torque Values.

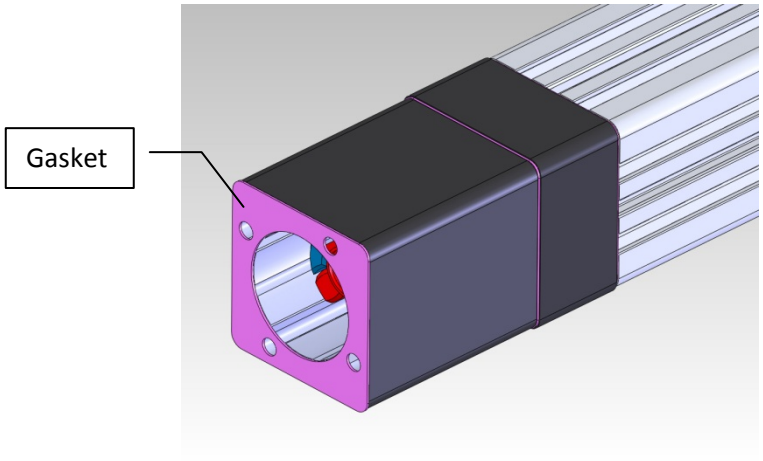
4.) Place an inline gasket over the pilot feature of the end cap so it is flush with the end cap. Ensure that the correct face of the gasket is mated with the face of the end cap, otherwise the mounting holes will not line up. See figure below.



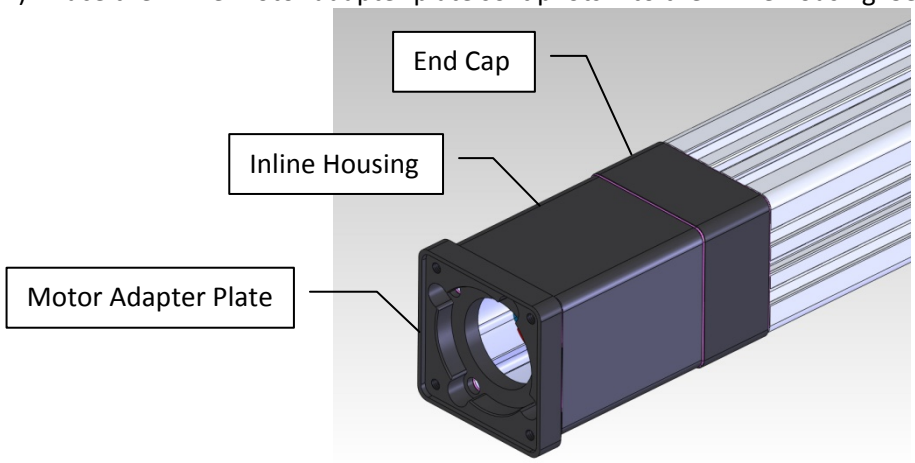
5.) Place the inline housing over the pilot feature of the end cap. Take care to make sure that the correct end of the inline housing is mated with the inline gasket and end cap otherwise the mounting holes will not line up. See figure next page.



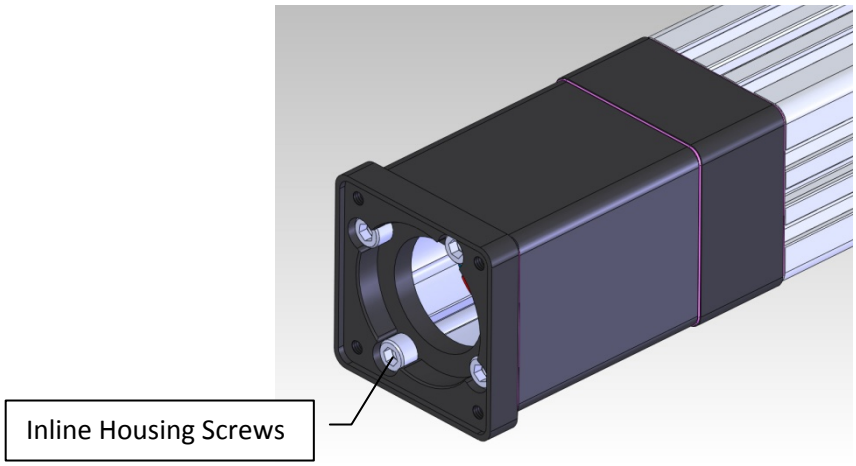
6.) Place an inline gasket so its face is flush with the inline housing end. Ensure that the correct face of the gasket is mated with the face of the inline housing, otherwise the mounting holes will not line up. See figure below.



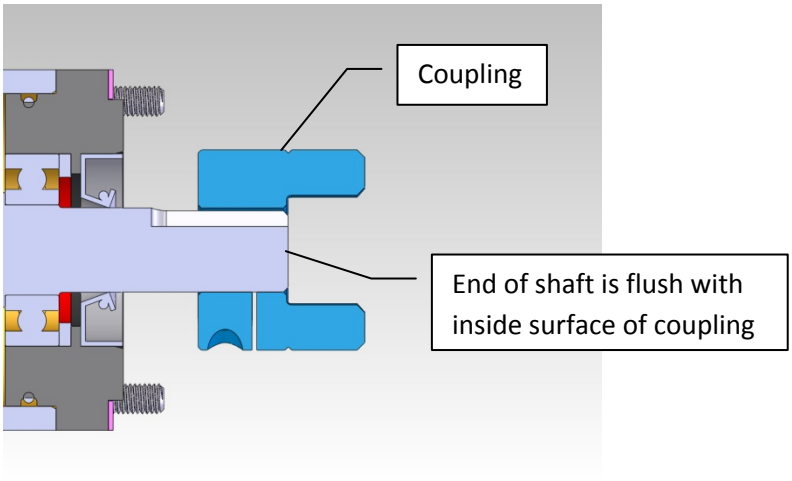
7.) Place the inline motor adapter plate so it pilots into the inline housing. See figure below.



8.) Insert the 4 inline housing screws and tighten to the designated torque value. (see table in Section 3.9). See figure next page.

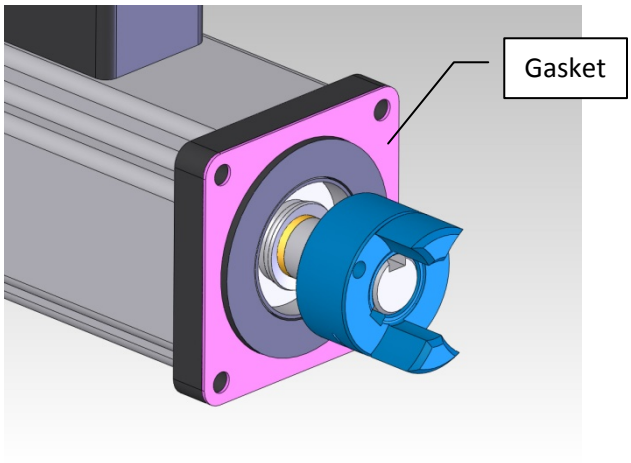


9.) Slide the coupling for the output motor shaft onto the motor output shaft until the inside surface of the coupling is flush with the end of the motor output shaft. See figure below.

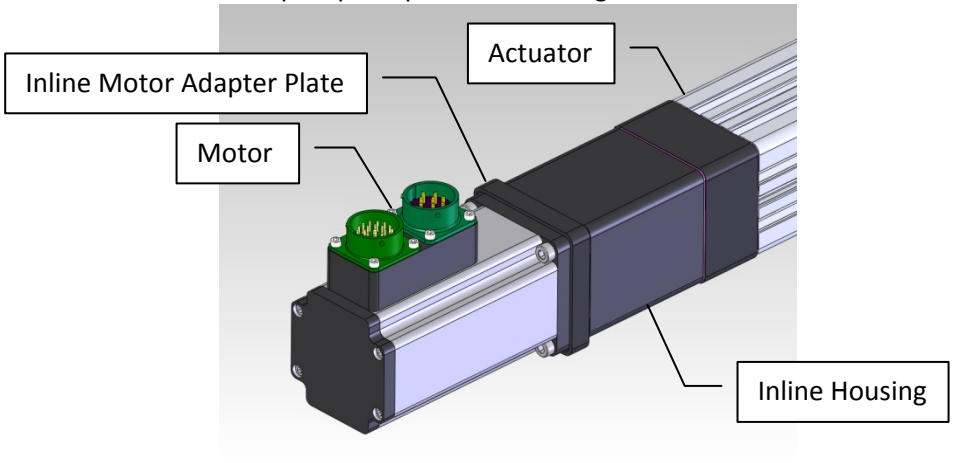


10.) Torque the coupling clamp screw. See Section 3.9 Fastener Torque Values.

11.) Place a motor gasket over the pilot feature of the motor face plate so it is flush with the face of the end cap. See figure next page.



12.) Insert the shaft of the motor into the inline housing with the motor coupling aligned to mate with the actuator coupling. Slide the motor in so the motor gasket and face plate flange is flush with the inline motor adapter plate pilot face. See figure below.



13.) Torque the motor screws to the designated torque value. See Section 3.9 Fastener Torque Values.

Actuator Disassembly

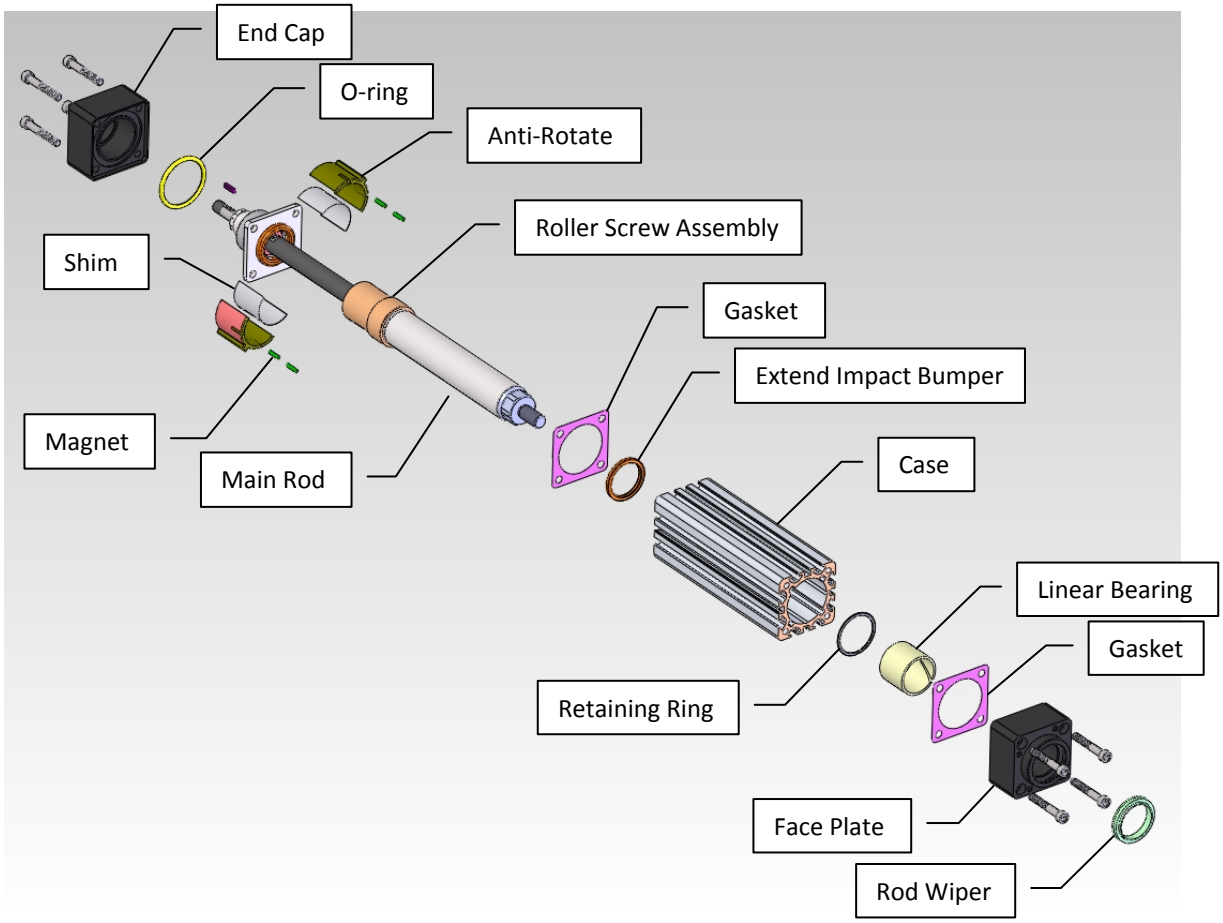
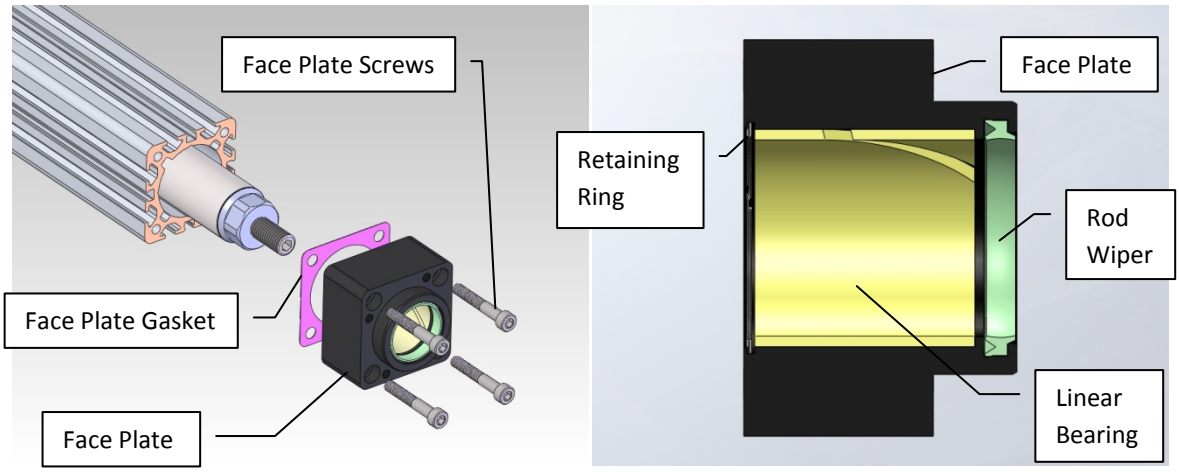
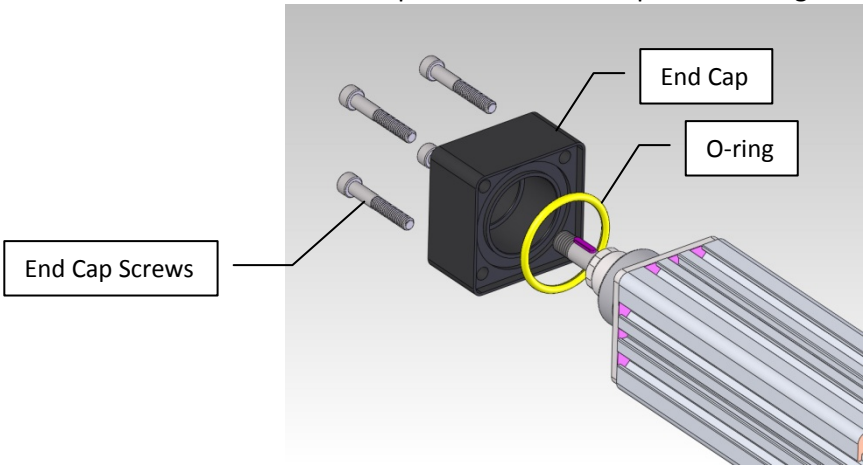


Figure: Actuator Disassembly

1.) Remove the face plate screws and slide face plate and face plate gasket off the main rod. Note to remove or replace rod wiper use a thin-bladed screw driver on the outer edge of the wiper seal where it seats into the face plate and pry it out. Also, at this time, you may remove the linear bearing. To remove the linear bearing, the retaining ring must be removed first using a thin-bladed screw driver. Note that not all K series actuators have a retaining ring to remove. It is not necessary to remove the rod wiper or the linear bearing unless they need to be replaced. See figures below.

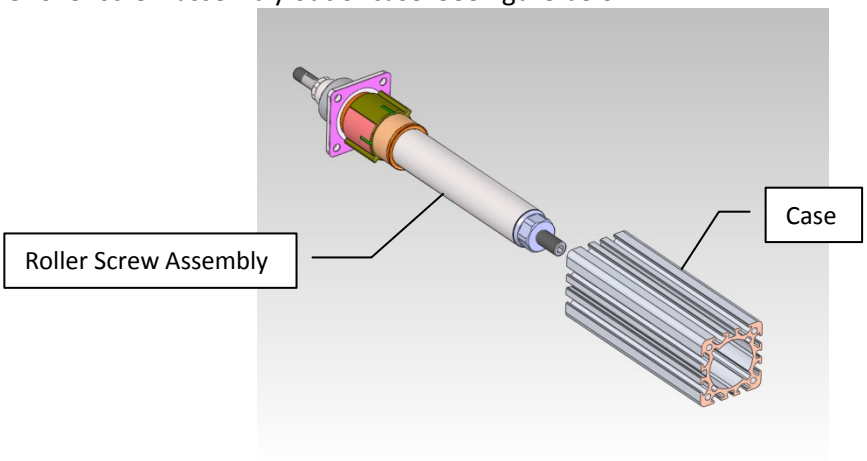


2.) Loosen and remove the end cap screws and slide the end cap off the bearings. You will then be able to remove the o-ring from the end cap. Note: A shaft seal is used on KT actuators and can then be removed from the end cap if it needs to be replaced. See figure below.

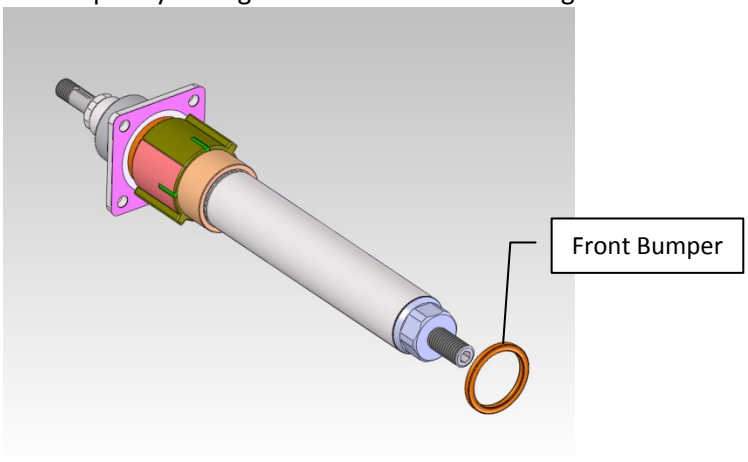


3.) Remove the key from the input shaft.

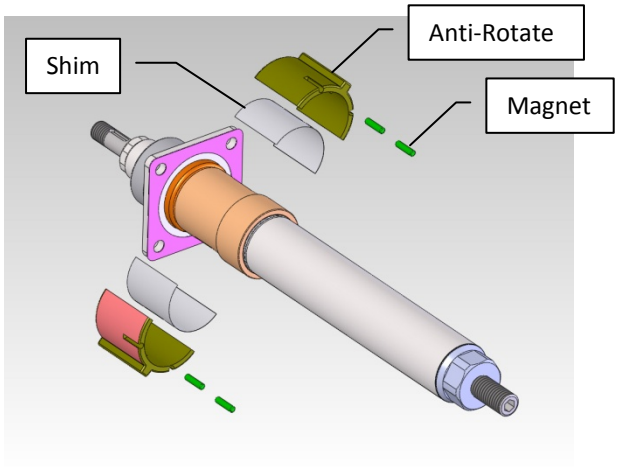
4.) Slide roller screw assembly out of case. See figure below.



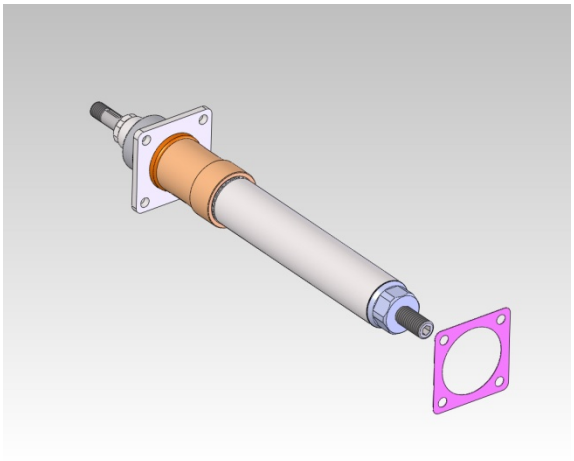
5.) Remove the extend impact bumper by sliding it off the main rod. See figure below.



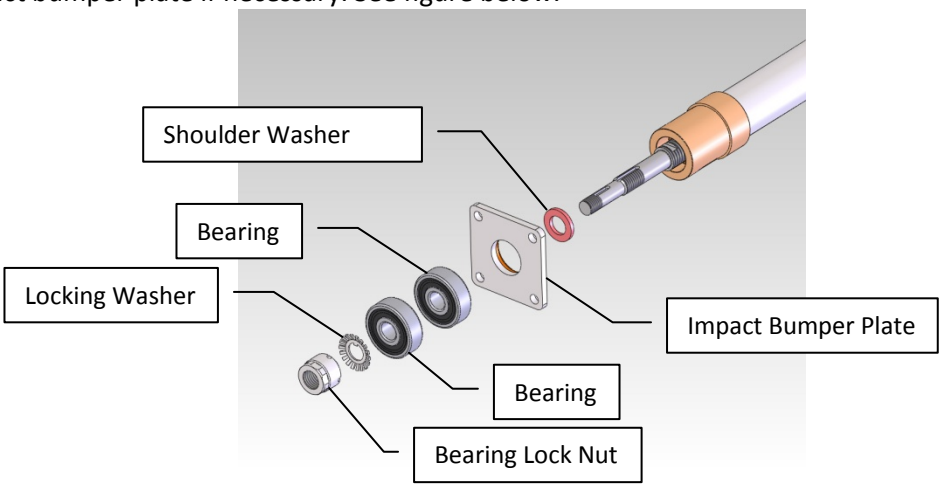
6.) Remove both the anti-rotates from the roller screw nut assembly by using a flat bladed screwdriver to pry between the anti-rotates until they separate from the roller screw nut assembly. Remove shim/shims from the roller screw nut assembly. Note that your actuator may have two, one, or no shims. Remove the magnets by sliding them out of the magnet retaining slots. Note that your K series actuator may use more than one magnet per magnet retaining slot. See figure below.



7.) Remove the gasket that is located by the bearing pack and slide it over the roller screw assembly. See figure next page.

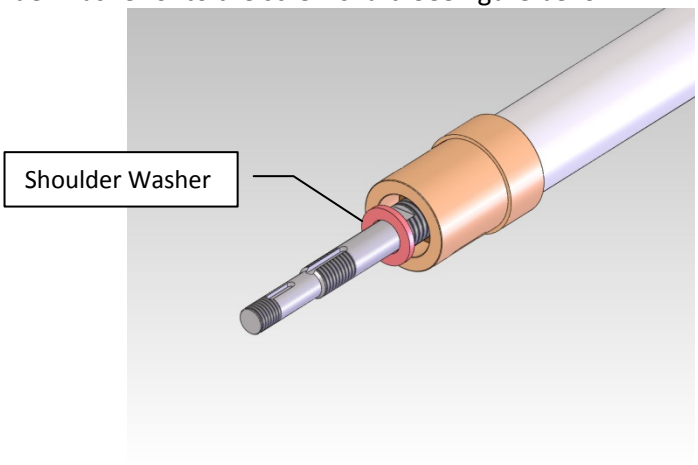


8.) Remove the bearings using a bearing puller in order to replace the bearings and/or the rear impact bumper plate if necessary. See figure below.

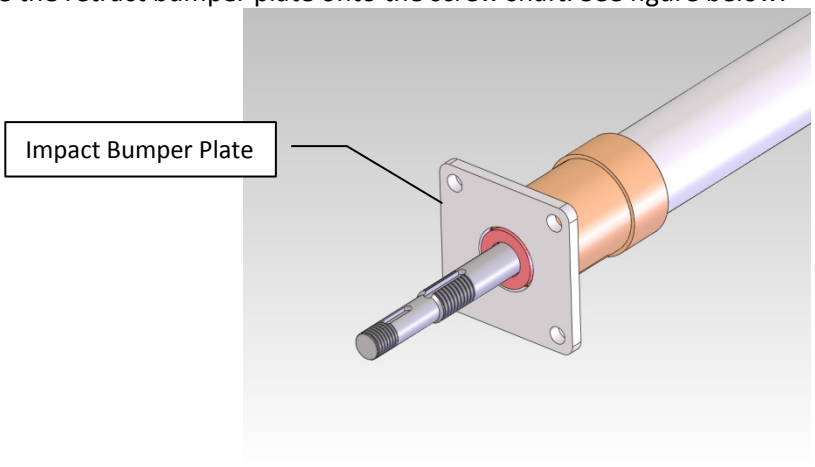


Actuator Reassembly

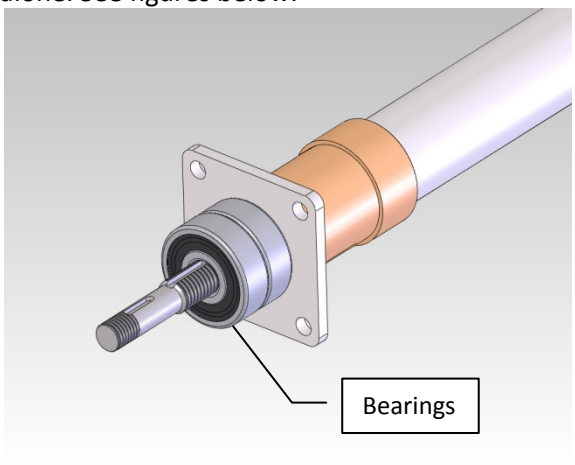
1.) Place the shoulder washer onto the screw shaft. See figure bellow.

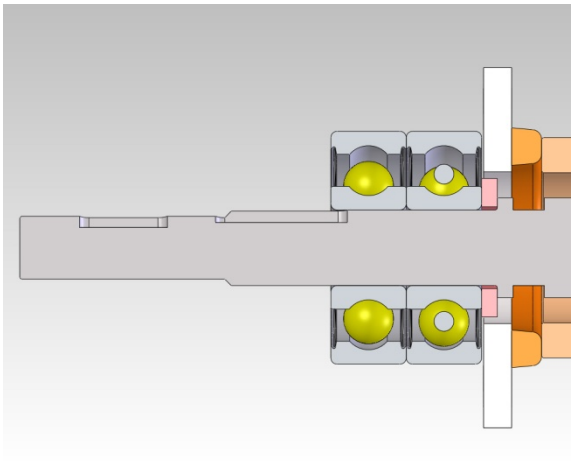


2.) Place the retract bumper plate onto the screw shaft. See figure below.

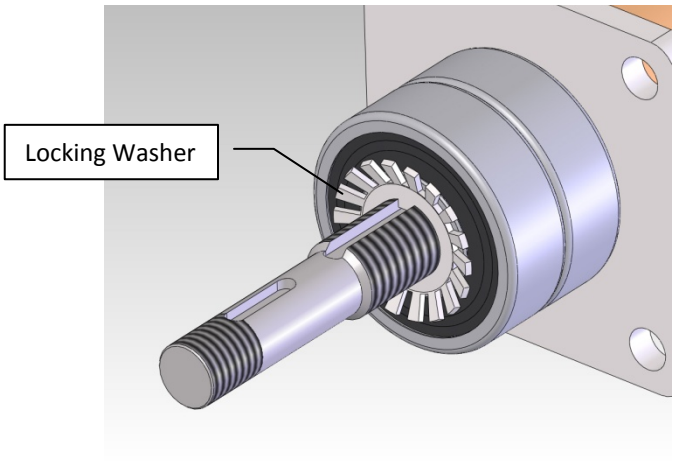


3.) Press the bearings onto the screw shaft. Be sure to press only on the inner race of each bearing or press on both the inner and outer races of each bearing equally using a tool that can accommodate these pressing requirements. DO NOT PRESS on the outer race of each bearing alone. See figures below.

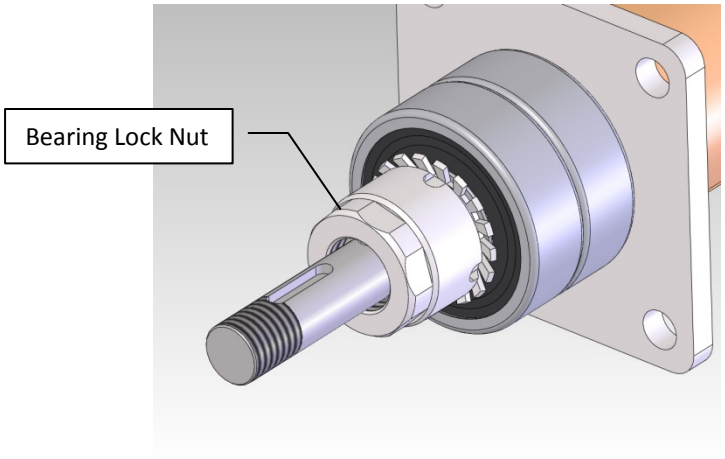




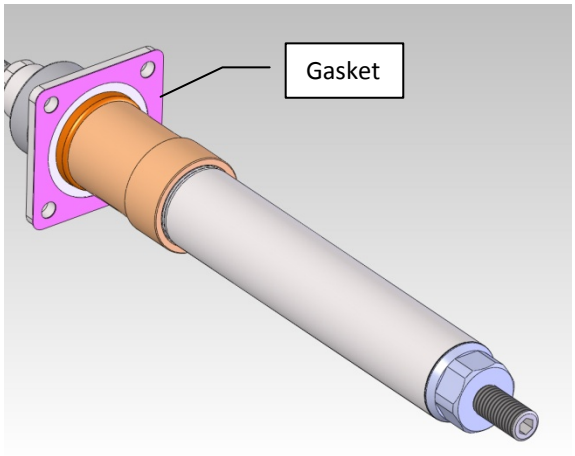
4.) Place the locking washer onto the screw shaft. Make sure that the inner tang on the locking washer is placed into the keyway. See figure below.



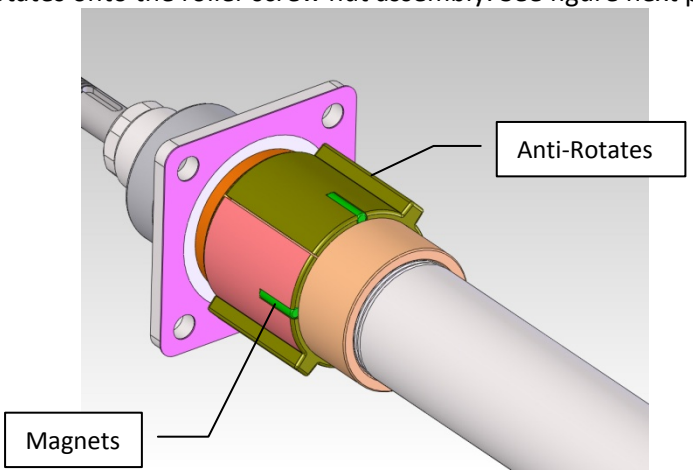
5.) Torque the bearing lock nut onto the screw shaft and lock down a tang on the locking washer into the closest aligning notch on the bearing lock nut. See Section 3.9 Fastener Torque Values. See figure below.



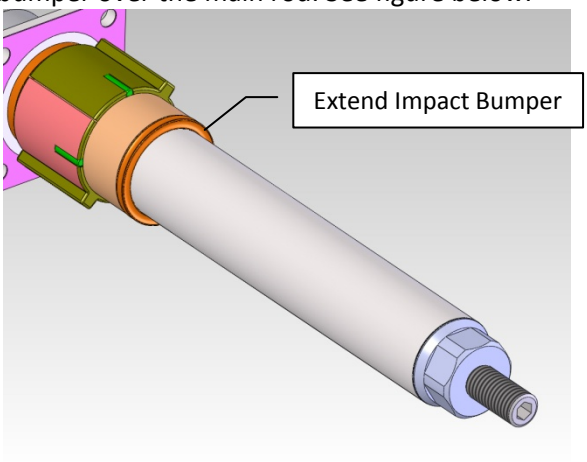
6.) Place the retract bumper plate gasket over the main rod and place it against the bumper plate. See figure below.



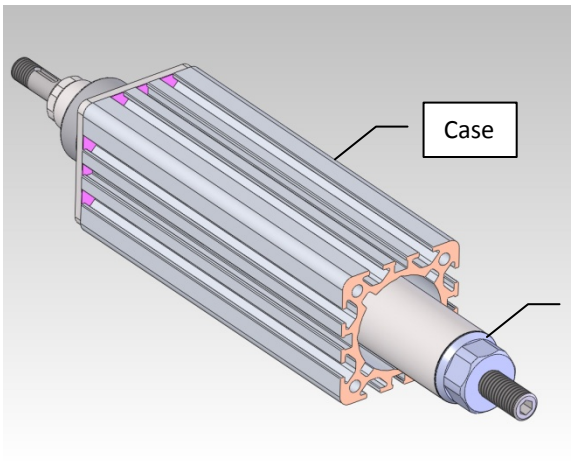
7.) Insert the four limit switch magnets into the anti-rotates magnets holes. Insert the 2 or 1 shims onto the roller screw nut assembly. Note that there may be no shims used on your actuator. Insert both anti-rotates onto the roller screw nut assembly. See figure next page.



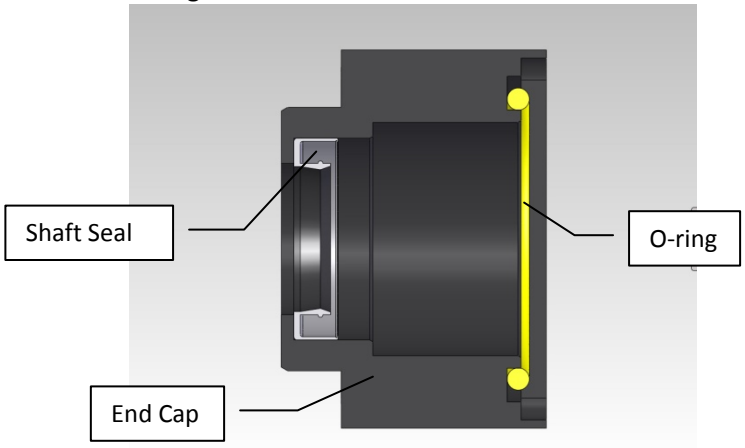
8.) Slide the extend impact bumper over the main rod. See figure below.



9.) Insert the main rod assembly into the case, rod end first, until the anti-rotate mechanism touches the case end. The case ends are identical in diameter, mounting hole, anti-rotate, t-slot, and limit switch size and orientation; therefore, there isn't a wrong orientation to inserting the main rod assembly into the case. Rotate the anti-rotate mechanism until it aligns with an anti-rotate groove that allows the main rod assembly to slide in with ease. Keep rotating until the easiest sliding groove is found and slide it the rest of the way into the case until the main rod assembly reaches the retract bumper plate. See figure next page.

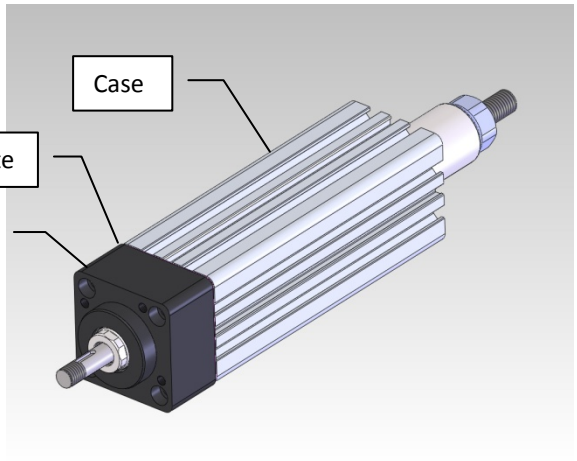


10.) Insert the shaft seal into the end cap with the open side of the shaft seal facing toward the retract impact bumper plate using a press or pressing tools. Note: The shaft seal is only used on the KT Series actuators. See figure below.



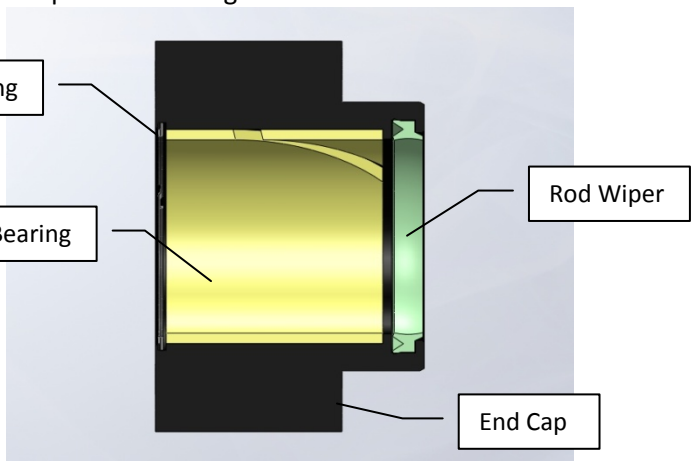
11.) Insert the o-ring into the end cap o-ring groove. Use some lube to help retain the o-ring so it doesn't fall out of the groove. See figure above.

12.) Slide the end cap over the shaft and bearings until it contacts the bumper plate and case. See figure next page.

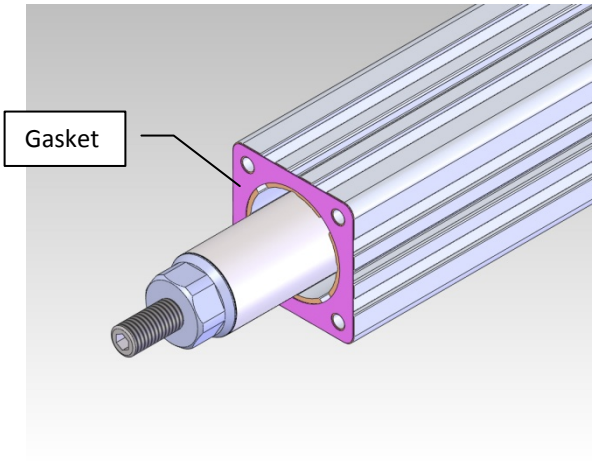


13.) Torque the four end cap screws and use the torque values provided in Section 3.9 Fastener Torque Values.

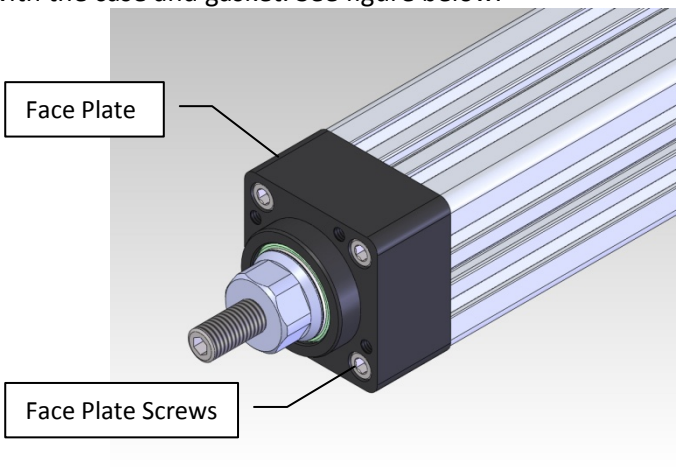
14.) Insert the linear bearing into the face plate bushing groove by folding in one end under the other and squeezing down the diameter of the bushing and placing it into the face plate until it snaps into place and is retained on both ends of the linear bushing in the face plate. Note some K series actuators use a retaining ring. Once the linear bearing is in place insert the retaining ring. Insert the wiper seal into the wiper seal groove with the closed end facing toward the rod output end. Lubricate the wiper seal. See figure below.



15.) Place the face plate gasket onto the main rod and move it toward the case until the gasket is flush against the case. See figure next page.

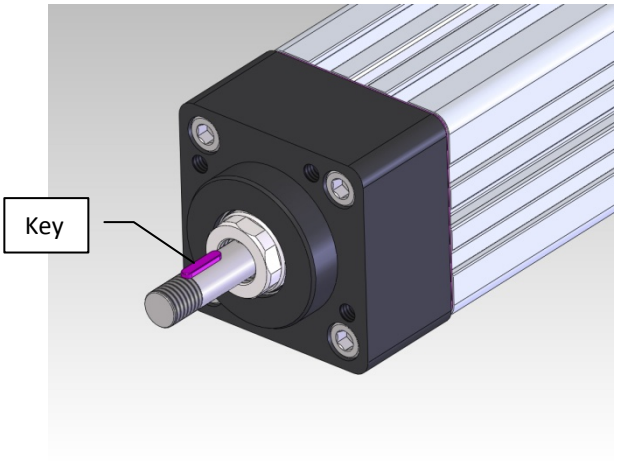


16.) Slide the face plate over the main rod and gently tap the face plate until the rod wiper rides onto the main rod. Once the wiper seal is over the main rod continue to slide toward the case until it is flush with the case and gasket. See figure below.



17.) Torque the four face plate screws and use the torque values provided in Section 3.9 Fastener Torque Values.

18.) Place the key in the keyway and take care that the key does not fall out.



19.) The drive train can now be reassembled. On K Series that are parallel motor mount, check the belt for wear. If the belt has excessive wear it may be necessary to replace it. See Parallel Motor and Actuator Mounting and Inline Motor and Actuator Mounting in Section 3.8 Disassembly and Reassembly Procedure.

3.9 Fastener Torque Values

K60 Fastener Torque Values	Torque in-lbs	Torque ft-lbs	Torque N-m
Base Unit			
Screw, M6 x 1.0x40mm, SHCS, SS (8X)-----Face Plate and End Cap	96	8	11
Bearing Lock Nut	216	18	24
Nut, M6 x 1 Hex Nylon Insert-----Rod End Bushing	96	8	11
Inline Motor Mount Unit			
Screw, M6 x 1.0x40mm, SHCS, SS (8X)-----Face Plate and End Cap	96	8	11
Bearing Lock Nut	216	18	24
Nut, M6 x 1 Hex Nylon Insert-----Rod End Bushing	96	8	11
Screw, M5 x 0.8 x 18mm, SHCS-SS (4X)-----Motor Mount	56	4.7	6.4
Screw, M6 x 1.0x25mm, SHCS, SS (4X)-----Motor Mount	96	8	11
Screw, 10-24 x .625", SHCS, SS (4X)-----Motor Mount	80	6.7	9
Screw, 10-24 x .75", SHCS, SS (4X)-----Motor Mount	80	6.7	9
Screw, M6 x 1.0x90mm, SHCS, SS (4X)-----Inline Housing	96	8	11
Coupling Clamp Screw, 25.4mm OD Coupling, M3 Alloy	18	1.5	2
Coupling Clamp Screw, 33.3mm OD Coupling, M3 Alloy	18	1.5	2
Coupling Clamp Screw, 41.3mm OD Coupling, M4 Alloy	41	3.4	4.6
Screw, M6 x 1.0 x 10mm, SHCS, SS-----T-Slot Screws	120	10	13.5
Screw, M6 x 1.0x14mm, SHCS, SS (4X)-----Front Mounts	96	8	11
Parallel Motor Mount Unit			
Screw, M6 x 1.0x40mm, SHCS, SS (8X)-----Face Plate and End Cap	96	8	11
Bearing Lock Nut	216	18	24
Nut, M6 x 1 Hex Nylon Insert-----Rod End Bushing	96	8	11
Screw, M5 x 0.8 x 18mm, SHCS-SS (4X)-----Motor Mount	56	4.7	6.4
Screw, M6 x 1.0x25mm, SHCS, SS (4X)-----Motor Mount	96	8	11
Screw, 10-24 x .625", SHCS, SS (4X)-----Motor Mount	80	6.7	9
Screw, M6 x 1.0 x 40mm, SHCS, SS (4X)-----Motor Mount	80	6.7	9
Screw, M6 x 1.0 x 50mm, SHCS-SS (6X)-----Pulley Cover	96	8	11
Screw, M8 x 1.25 x 55mm, SHCS-SS (6X)-----Pulley Cover	228	19	25.8
Screw, M10 x 1.5 x 65mm, SHCS-SS (6X)-----Pulley Cover	456	38	51.5
Screw, M5 x 0.8 x 8 SHSS cup pt.-----Pulley Set screw	56	4.7	6.4
Screw, 10-24 x .375" SHSS cup pt.-----Pulley Set Screw	40	3.3	4.5
Nut, M10 x 1.5, Flange, Serrated-----Pulley Nut	180	15	20
Screw, M6 x 1.0 x 14mm, SHCS, SS (8X)--Rear & Frt Mnts and Motor Pla	96	8	11
Screw, 6mm x 20mm Shoulder Bolt-----Idler Pulley screw	56	4.7	6.4
Screw, M6 x1 .0 x 10mm, SBHCS, SS-----Idler Adj screw	96	8	11
Screw, M6 X 1.0 x 10mm, SHCS, SS-----T-Slot Screws	120	10	13.5

K90 Fastener Torque Values	Torque in-lbs	Torque ft-lbs	Torque N-m
Base Unit			
Screw, M10 x 1.5x60mm, SHCS, SS (8X)-----Face Plate and End Cap	456	38	51.5
Bearing Lock Nut	840	70	95
Nut, M10 x 1.5 Hex Nylon Insert-----Rod End Bushing	180	15	20
Inline Motor Mount Unit			
Screw, M10 x 1.5 x 60mm, SHCS, SS (8X)-----Face Plate and End Cap	456	38	51.5
Bearing Lock Nut	840	70	95
Nut, M10 x 1.5 Hex Nylon Insert-----Rod End Bushing	180	15	20
Screw, M5 x 0.8 x 18mm, SHCS-SS (4X)-----Motor Mount	56	4.7	6.4
Screw, M6 x 1.0 x 25mm, SHCS, SS (4X)-----Motor Mount	96	8	11
Screw, M8 x 1.25 x 30mm, SHCS, SS (4X)-----Motor Mount	228	19	25.8
Screw, 10-24 x .75", SHCS, SS (4X)-----Motor Mount	80	6.7	9
Screw, M10 x 1.5 x 60mm, SHCS, SS (4X)-----Inline Housing	456	38	51.5
Coupling Clamp Screw, 41.3mm OD Coupling, M4 Alloy	40.7	3.4	4.6
Coupling Clamp Screw, 50.8mm OD Coupling, M5 Alloy	84	7	9.5
Screw, M8 x 1.25, SHCS-----T-Slot Screws	264	22	30
Screw, M10 x 1.5 x 25mm, SHCS, SS (4X)-----Front Mounts	456	38	51.5
Parallel Motor Mount Unit			
Screw, M10 x 1.5 x 60mm, SHCS, SS (8X)-----Face Plate and End Cap	456	38	51.5
Bearing Lock Nut	840	70	95
Nut, M10 x 1.5 Hex Nylon Insert-----Rod End Bushing	180	15	20.3
Screw, M5 x 0.8 x 18mm SHCS-SS (4X)-----Motor Mount	56	4.7	6.4
Screw, M6 x 1.0 x 25mm SHCS-SS (4X)-----Motor Mount	96	8	11
Screw, M8x1.25 x 30mm SHCS-SS (4X)-----Motor Mount	228	19	25.8
Screw, 10-24 x .75" SHCS-SS (4X)-----Motor Mount	80	6.7	9
Screw, M10 x 1.5 x 60mm, SHCS-SS (6X)-----Pulley Cover	456	38	51.5
Screw, M5 x 0.8 x 8 SHSS cup pt.-----Pulley Set screw	56	4.7	6.4
Screw, M6 x 1.0 x 10 SHSS cup pt.-----Pulley Set screw	96	8	11
Screw, 10-24 x .375" SHSS cup pt.-----Pulley Set screw	40	3.3	4.5
Nut, M16 x 2.0, Flange, Serrated-----Pulley Nut	456	38	51.5
Screw, M10x1.5x25mm, SHCS, SS (8X)--Rear & Frt Mnts and Motor Plat	456	38	51.5
Screw, 6mmx20mm Shoulder Bolt--Idler Pulley screw, 15mm Wide Be	56	4.7	6.4
Screw, 8mmx20mm Shoulder Bolt--Idler Pulley screw, 25mm Wide Be	96	8	11
Screw, M6x1.0x10mm, SBHCS, SS-----Idler Adj screw	96	8	11
Screw, M8X1.25, SHCS-----T-Slot Screws	264	22	30

4.0 Optional Equipment

4.1 Mounting Options

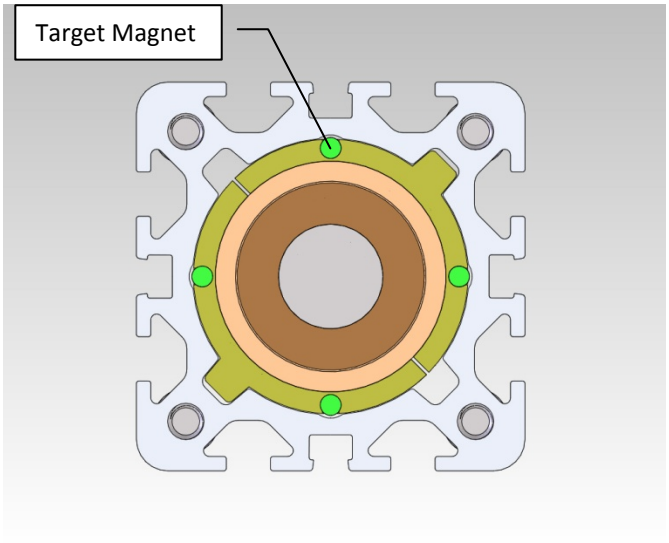
Standard mounting configurations are adjustable foot plates and trunnions, angle plates, front and rear flange mounts, eye plates and clevis plates. *See Section 2.0 Installation for more details.*

4.2 Standard Motor Mounting Configurations

The K Series actuators are offered in two standard motor mounting configurations, parallel and inline. Each standard motor mounting is designed to accommodate Exlar Servo motors SLM and SLG 60, and 90, Nema 23 and 34 motors, and Tritex motors. Custom motors can be accommodated with custom mounting, although due to custom motor size, torque, and speed, not all custom motors or reducers can be mounted to each standard actuator. Contact Exlar Corporation application engineers for custom mounting considerations. *See section 5.0 Specifications for torque specifications required to drive application load levels.*

4.3 Limit Switches

The K Series actuator is equipped for adjustable externally mounted limit switches. Exlar offers magnetic inductive proximity switches that are triggered by a target magnet that is located in the anti-rotate mechanisms inside of the actuator housing. The location of the four target magnets allow switches to be mounted on any side of the actuator. See figure 15.



The limit switches are available with normally open and normally closed output, channel mount magnetic sensing prox.

L# options: External Limit Switches, channel mount magnetic sensing prox, please specify.

Configuration of Logic of Standard Switch Option Selections			
Option	**SW1**	**SW2**	**SW3**
L1	Not Supplied	Normally Open	Not Supplied
L2	Normally Closed	Not Supplied	Normally Closed
L3	Normally Closed	Normally Open	Normally Closed
Switch Type	**Exlar Part Number**		
Normally Closed Switch	43404	Turck PN BIM-UNT-RP6X	
Normally Open Switch	43403	Turck PN BIM-UNT-AP6X	

For custom logic combinations, contact Exlar applications engineering.

The magnetic inductive switch power is 10-30 VDC with a no-load operating current of <10mA and a load current of less than or equal to 200 mA.

4.4 Rod Ends

Standard K Series Rod End Thread Specifications	**US Male**	**US Female**	**Metric Male**	**Metric Female**
K60	1/2-20	1/2-20	M12 X 1.25	M12 X 1.25
K90	3/4-16	3/4-16	M20 X 1.5	M20 X 1.5

Please Contact Exlar for rod end drawings.

5.0 Specifications

5.1 Travel Life Calculations

Travel life estimates of a roller screw in a linear application, cubic mean load should be used. The mathematical formulas that define these values follow the chart below.

K60			
Lead of Screw	**Load (Max) lbf (kN)**	**Load (Dynamic) lbf (kN)**	**Torque @ Load (Max) lbf-in (N-m)**
KM 5mm	1,350 (6.00)	1,723 (7.67)	52.6 (5.94)
KM 10mm	675 (3.00)	1,526 (6.79)	52.6 (5.94)
KX 5mm	1,350 (6.00)	2,360 (10.50)	52.6 (5.94)
KX 10mm	675 (3.00)	2,091 (9.30)	52.6 (5.94)
KT 5mm	1,800 (8.00)	3,300 (14.68)	70.5 (7.97)
KT 10mm	900 (4.00)	2,900 (12.90)	70.5 (7.97)
KA .1 in	830 (3.69)	N/A	52.6 (5.94)
KA .2 in	697 (3.10)	N/A	52.6 (5.94

K90			
Lead of Screw	**Load (Max) lbf (kN)**	**Load (Dynamic) lbf (kN)**	**Torque @ Load (Max) lbf-in (N-m)**
KM 5mm	3500 (15.57)	7800 (34.70)	137.07 (15.48)
KM 10mm	1750 (7.78)	7000 (31.13)	137.07 (15.48)
KX 5mm	3500 (15.57)	11000 (48.93)	137.07 (15.48)
KX 10mm	1750 (7.78)	11000 (48.93)	137.07 (15.48)
KT 5mm	3500 (15.57)	15000 (66.72)	137.07 (15.48)
KT 10mm	1750 (7.78)	13500 (60.05)	137.07 (15.48)
KA .1 in	1549 (6.89)	N/A	137.07 (15.48)
KA .2 in	1291 (5.74)	N/A	137.07 (15.48)

Do not exceed the maximum load rating. Doing so may cause damage to the actuator or injury.

$L_{10} = (C/F)^3 S$

$F = [(F_1^3 s_1 + F_2^3 s_2 + F_3^3 s_3 + \ldots)/(s_1 + s_2 + s_3 + \ldots)^]1/3$

Where:

L_{10} = Travel life in millions of inches (mm)

C = Dynamic load rating of roller screw, lbf (N)

F = Cubic mean load applied, lbf (N)

S = Roller screw lead, inches (mm)

$F_{1,2,3}\ldots$ = Force applied for corresponding $S_{1,2,3}\ldots$ length of travel distance, lbf (N)

$S_{1,2,3}\ldots$ = Length of travel distance for corresponding $F_{1,2,3}\ldots$ applied force, in (mm)

5.2 Load, Torque, and Linear Speed Calculations

Do not exceed the maximum load rating. Doing so may cause damage to the actuator or injury.

The thrust load applied by the K Series actuator is dependent on the torque applied to the roller screw input shaft and the lead of the roller screw. Any belt and pulley or gear reduction that increases motor torque should be factored into the calculation below.

The equation below defines the amount of torque required for a corresponding thrust force.

$$F = \frac{T \quad 2(6.2831) \quad N}{S}$$

Where:

T = Torque applied to roller screw shaft, in-lbf (N-m)
S = Roller screw lead, inches (mm)
F = Thrust for required, lbf (N)
N = Efficiency of system (0.8 for standard K Series actuator assemblies, unitless)

Motor torque will be required to accelerate the inertial components of the system in addition to the thrust. Consult Exlar's sizing guidelines for further details.

The resultant linear speed of the K Series actuator's output rod is a function of rotational speed of the roller screw input shaft and roller screw lead. Any gearbox reduction or belt and pulley speed reduction should be factored into the equation below. The equation below defines the linear speed produced by a K Series actuator.

$$V = nS$$

Where:

V = Linear speed, in/s (mm/s)
n = Rotational speed of roller screw shaft, rev/s
S = Roller screw Lead, in (mm)

Do not exceed the maximum load rating. Doing so may cause damage to the actuator or injury.

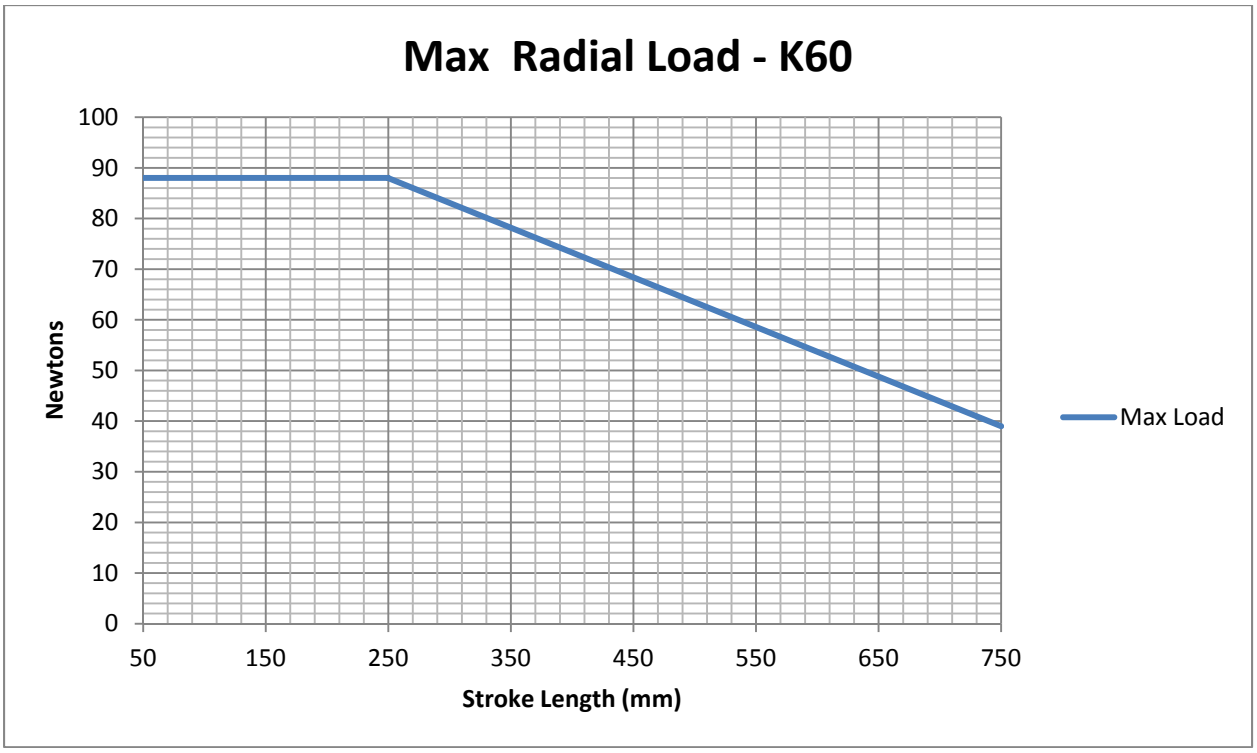
5.3 Column Strengths

K60					
Stroke inch (mm)	6 (150)	12 (300)	18 (450)	24 (610)	30 (760)
Roller Screw, 5 and 10mm leads lbs (N)	29,618 (120,911)	20,888 (85,272)	10,305 (42,068)	5,879 (24,000)	3795 (15,493)
Acme Screw .1 lead lbs (N)	18,848 (76,944)	10,272 (41,934)	4,668 (19,056)	2,655 (10,839)	1,711 (6,985)
Acme Screw .2 lead lbs (N)	18,848 (76,944)	10272 (41,934)	4,668 (19,056)	2,655 (10,839)	1,711 (6,985)

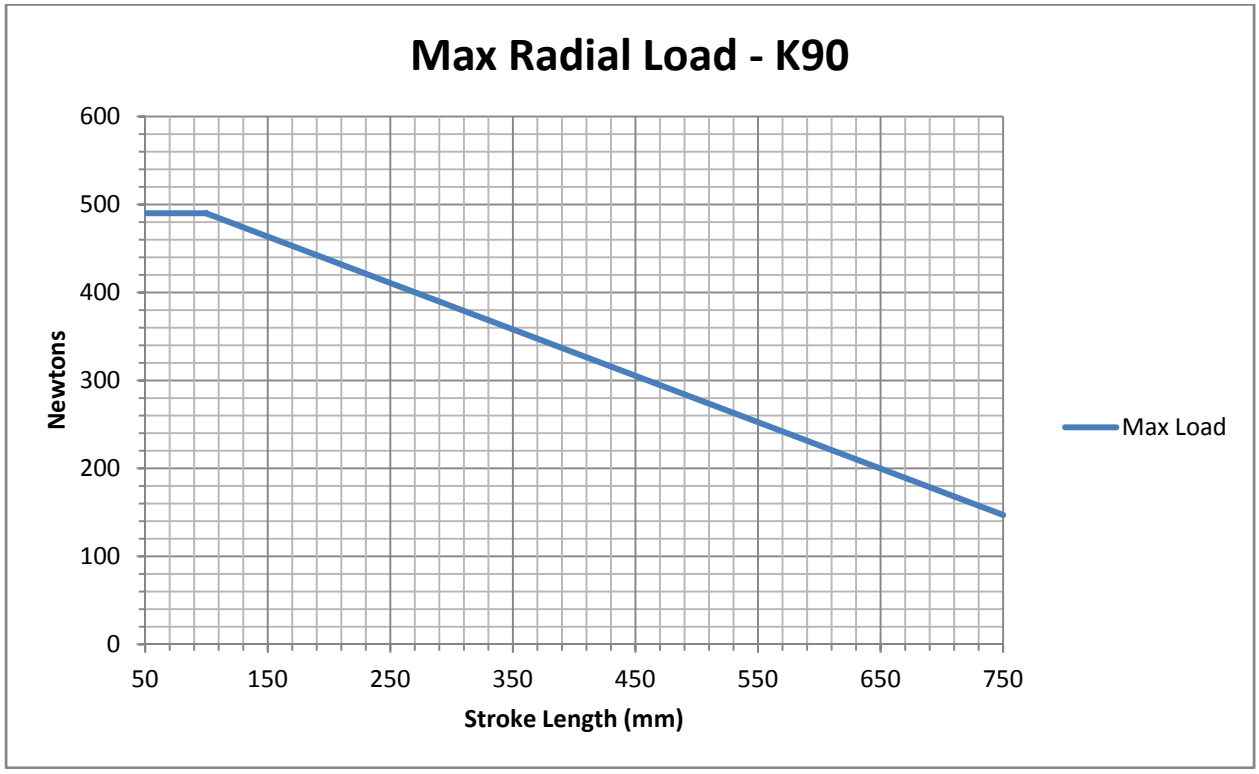
K90					
Stroke inch (mm)	6 (150)	12 (300)	18 (450)	24 (610)	30 (760)
Roller Screw, 5 and 10mm leads lbs (N)	98,830 (439,618)	93,551 (416,136)	78,868 (350,822)	58,684 (261,039)	38,578 (171,604)
Acme Screw .1 lead lbs (N)	65,477 (291,256)	56,310 (250,479)	41,642 (185,233)	25,088 (111,597)	16,316 (72,577)
Acme Screw .2 lead lbs (N)	49,271 (219,168)	40,104 (178,392)	25,478 (113,332)	14,716 (65,460)	9,571 (42,574)

5.4 Overhung Loads

K60 Max Radial Load



K90 Max Radial Load



5.5 Critical Speed

K60					
	Critical Speeds				
Stroke inch (mm)	6 (150)	12 (300)	18 (450)	24 (610)	30 (760)
Roller Screw, 5 and 10mm leads (rpm)	6600	6600	6600	6472	4178
Acme Screw .1 lead (rpm)	6600	6600	6600	4274	2754
Acme Screw .2 lead (rpm)	6600	6600	6600	4274	2754

K90					
	Critical Speeds				
Stroke inch (mm)	6 (150)	12 (300)	18 (450)	24 (610)	30 (760)
Roller Screw, 5 and 10mm leads (rpm)	5180	5180	5180	5180	5180
Acme Screw .1 lead (rpm)	92,214	26,737	12,517	7230	4702
Acme Screw .2 lead (rpm)	80,701	23,398	10,954	6327	4115

5.6 Inertias

K60	5 mm Lead lbf-in-sec^2 (kg-m^2)	Adder per 25 mm, 5 mm Lead lbf-in-sec^2 (kg-m^2)
Base Unit – Input Drive Shaft Only	1.31 x 10^{-4} (1.480 x 10^{-5})	9.045 x 10^{-6} (1.022 x 10^{-6})
Inline Unit w/Motor Coupling	2.39 x 10^{-4} (2.702 x 10^{-5})	9.045 x 10^{-6} (1.022 x 10^{-6})
1:1 Reduction Belt Drive (66 mm)	3.84 x 10^{-4} (4.339 x 10^{-5})	9.045 x 10^{-6} (1.022 x 10^{-6})
1:1 Reduction Belt Drive (86 mm)	6.53 x 10^{-4} (7.378 x 10^{-5})	9.045 x 10^{-6} (1.022 x 10^{-6})
1:1 Reduction Belt Drive (96 mm)	7.58 x 10^{-4} (8.564 x 10^{-5})	9.045 x 10^{-6} (1.022 x 10^{-6})
1.5:1 Reduction Belt Drive (86 mm)	4.44 x 10^{-4} (5.014 x 10^{-5})	4.020 x 10^{-6} (4.542 x 10^{-7})
2:1 Reduction Belt Drive (96 mm)	6.28 x 10^{-4} (7.095 x 10^{-5})	2.261 x 10^{-6} (2.555 x 10^{-7})
	10 mm Lead lbf-in-sec^2 (kg-m^2)	**Adder per 25 mm, 10 mm Lead lbf-in-sec^2 (kg-m^2)**
Base Unit – Input Drive Shaft Only	1.43 x 10^{-4} (1.616 x 10^{-5})	1.038 x 10^{-5} (1.173 x 10^{-6})
Inline Unit w/Motor Coupling	2.51 x 10^{-4} (2.837 x 10^{-5})	1.038 x 10^{-5} (1.173 x 10^{-6})
1:1 Reduction Belt Drive (66 mm)	3.96 x 10^{-4} (4.474 x 10^{-5})	1.038 x 10^{-5} (1.173 x 10^{-6})
1:1 Reduction Belt Drive (86 mm)	6.65 x 10^{-4} (7.514 x 10^{-5})	1.038 x 10^{-5} (1.173 x 10^{-6})
1:1 Reduction Belt Drive (96 mm)	7.70 x 10^{-4} (8.704 x 10^{-5})	1.038 x 10^{-5} (1.173 x 10^{-6})
1.5:1 Reduction Belt Drive (86 mm)	4.49 x 10^{-4} (5.075 x 10^{-5})	4.613 x 10^{-6} (5.211 x 10^{-7})
2:1 Reduction Belt Drive (96 mm)	1.74 x 10^{-4} (1.966 x 10^{-5})	2.595 x 10^{-6} (2.931 x 10^{-7})
See drawings for drive dimension reference		

K90	5 mm Lead lbf-in-sec^2 (kg-m^2)	Adder per 25 mm, 5 mm Lead lbf-in-sec^2 (kg-m^2)
Base Unit – Input Drive Shaft Only	2.63 x 10^{-3} (2.97 x 10^{-4})	9.80 x 10^{-5} (1.11 x 10^{-5})
Inline Unit w/Motor Coupling	3.40 x 10^{-3} (3.84 x 10^{-4})	9.80 x 10^{-5} (1.11 x 10^{-5})
1:1 Reduction Belt Drive (96 mm)	4.53 x 10^{-3} (5.12 x 10^{-4})	9.80 x 10^{-5} (1.11 x 10^{-5})
1:1 Reduction Belt Drive (130 mm)	1.35 x 10^{-2} (1.52 x 10^{-3})	9.80 x 10^{-5} (1.11 x 10^{-5})
2:1 Reduction Belt Drive (130 mm)	6.45 x 10^{-3} (7.29 x 10^{-4})	2.45 x 10^{-5} (2.77 x 10^{-6})
	10 mm Lead lbf-in-sec^2 (kg-m^2)	**Adder per 25 mm, 10 mm Lead lbf-in-sec^2 (kg-m^2)**
Base Unit – Input Drive Shaft Only	2.66 x 10^{-3} (3.00 x 10^{-4})	1.00 x 10^{-4} (1.13 x 10^{-6})
Inline Unit w/Motor Coupling	3.43 x 10^{-3} (3.87 x 10^{-4})	1.00 x 10^{-4} (1.1 3 x 10^{-5})
1:1 Reduction Belt Drive (96 mm)	4.56 x 10^{-3} (5.15 x 10^{-4})	1.00 x 10^{-4} (1.13 x 10^{-5})
1:1 Reduction Belt Drive (130 mm)	1.35 x 10^{-2} (1.53 x 10^{-3})	1.00 x 10^{-4} (1.13 x 10^{-5})
2:1 Reduction Belt Drive (130 mm)	6.46 x 10^{-3} (7.30 x 10^{-4})	2.50 x 10^{-5} (2.82 x 10^{-6})
See drawings for drive dimension reference		

5.7 Weights

K60	Weight	
	lb	kg
Base Unit - zero stroke	3.84	1.74
Adder per inch of stroke	0.46	0.21
Adder for inline (excluding motor)	1.53	0.70
Adder for parallel drive (excluding motor and pulleys) 1:1	1.97	0.89
Adder for parallel drive (excluding motor and pulleys) 1.5:1	2.52	1.14
Adder for parallel drive (excluding motor and pulleys) 2:1	5.59	2.54
Adder for 2 foot plate mounts	1.15	0.52
Adder for 2 trunnions	1.15	0.52
Adder for a front flange plate	0.91	0.41
Adder for a rear flange plate	1.19	0.54
Adder for 2 angle plates	0.57	0.26
Adder for an eye plate	0.65	0.30
Adder for a clevis plate	0.62	0.28

K90	Weight	
	lb	kg
Base Unit - zero stroke	11.96	5.42
Adder per inch of stroke	0.93	0.42
Adder for inline (excluding motor)	3.35	1.51
Adder for parallel drive (excluding motor and pulleys)	5.8	2.62
Adder for 2 foot plate mounts	3.78	1.71
Adder for 2 trunnions	1.77	0.8
Adder for a front flange plate	3.4	1.54
Adder for a rear flange plate	4.79	2.2
Adder for 2 angle plates	1.97	0.9
Adder for an eye plate	2.49	1.13
Adder for a clevis plate	3.21	1.46

6.0 Troubleshooting

6.1 Mechanical Problems

The following table offers suggestions to answer questions and offer solutions to issues that may arise during the installation or operation of your K Series actuator.

Symptom/Problem	Possible Cause	Problem Solution
Seemingly excessive noise.	Misalignment or Side Load.	Check alignment with application, remount actuator if necessary. Remove side load.
Seemingly excessive noise.	Improper servo tuning.	Consult tuning guidelines for servo motor and drive.
Actuator motor rotates but output rod does not extend or retract.	Belt or inline coupling failure.	Disconnect power to motor, remove belt cover and inspect belt or inline coupling. Replace if necessary.
Motor does not operate.	Motor electrical problem.	Consult motor manufacturer.
Output rod has excessive rotation, or rotates but does not extend.	Anti-rotate failure.	Replace anti-rotate mechanism.
Excessive motor current to operate actuator.	An internal mechanism binding, application binding, roller screw failure. Operation over peak load rating.	Consult Exlar.
Rapid Belt Wear	Belt too loose or too tight	Tighten or Loosen Belt
Main Rod (Output Rod) does not extend	Broken anti-rotate, jammed rollerscrew nut, broken belt, pulley loose, or coupling loose	Replace anti-rotates, replace rollerscrew nut, replace belt, tighten pulley, or tighten coupling
Seemingly excessive noise.	Bad roller screw or bearings	Replace roller screw or bearings
Rapid wear of anti-rotate or linear bearing	High over-hung load	Remove high overhung load
Mounting accessories slip on t-nuts	Too much load	Reduce load and tighten screws

6.2 Returning a Product for Repair

STANDARD REPAIR LEADTIME:

- Two weeks for written evaluation from Exlar
- Two weeks from receipt of approval (by fax or email) for repair where parts are available.

- An evaluation charge per unit after evaluation applies if customer chooses not to repair; or if product is found not in need of repair.

EXPEDITED REPAIR LEADTIME:

- An expedite charge per unit can be quoted.
- This provides one week for written evaluation from Exlar
- This provides one week from receipt of approval (by fax or email) for repair where parts are available.

PROCEDURE:

- Please discuss the return with Exlar Technical Support prior to requesting an RGA number to see if it is possible to resolve the issue prior to return.

- If it is determined that an RGA number is required, please do so by contacting the Returned Goods Administrator. Phone 952-500-6200 or email returns@exlar.com.
    - International Repairs: Closely follow instructions provided by the Exlar Returned Goods Administrator. Failure to comply with issued instructions may result in delays for repair and return.

- Exlar requires a purchase order at the time of RGA; $0 on warranty returns, or for the standard evaluation charge per unit on all non-warranty units for the evaluation fee.

- Following the evaluation, you will receive a quote from Exlar on the charges that will apply. If the actuator repair is approved, the evaluation fee will be waived and we will request an amended PO for the actual repair value.